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The Risky Side of Creativity: A Scientific Investigation of Creativity and Domain Specific Risk Taking

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The Risky Side of Creativity:
A Scientific Investigation of Creativity and Domain Specific Risk Taking

by

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A Scientific Investigation of Creativity and Domain Specific Risk Taking

ABSTRACT

Previous researchers have often speculated about the role of risk taking in creativity, however this association has rarely been systematically investigated. This thesis explores the association between domain specific risk taking and creativity in human participants. It presents a systematic review of the speculations and scientific studies which aimed at uncovering the association between creativity and risk taking in various populations. This discussion aims to bring together the current knowledge centred around the link between risk taking and creativity and poses two overarching questions – Are creative individuals risk takers and if so, is this association domain specific? In five studies, the present research investigated these questions and found that creativity is strongly associated with risk taking in the social domain (but not in the financial, ethical, health/ safety or recreational domains). Additionally, with an aim to further disentangle the association between creativity and risk taking in specific populations and social situations, this thesis explored creativity in a specific group of individuals (sexual minority) who are speculated to be highly creative and are known to be more likely to take health/ safety risks such as smoking tobacco, consuming illegal drugs or engaging in unsafe sexual encounters. It was found that sexual minority (specifically bisexual individuals) were highly creative and were also more likely to take risks in various domains. As opposed to the sexual minority, another group of individuals in which creativity and risk taking are hypothesised to be different, consists of individuals who subscribe to the right-wing socio-political ideologies. As predicted, individuals who affiliated to the right-wing socio-political ideologies (in the United States) were found to be low on creativity and were significantly less likely to take risks, specifically in the social domain. A mediating role of social risk taking on the relationship between socio-political attitudes and creativity was also found. The research work presented in this thesis illustrates the role that social risk taking plays in creativity and paves way for the development of new ways to foster creativity.

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List Of Abbreviations

BF = Bayes Factor

CPS = Creative Personality Scale

RIBSs = Runco Ideation Behavioural Scale – short form

DOSPERT = Domain Specific Risk Taking Questionnaire

CAQ = Creative Achievement Questionnaire

AUT = Alternate Uses Task

cRAT = Compound Remote Associates Task

DT = Divergent Thinking

RBT = Roulette Betting Task

RWA = Right Wing Authoritarianism

SDO = Social Dominance Orientation

SDO-AE = Social Dominance Orientation – Anti-Egalitarianism

SDO-D = Social Dominance Orientation – Dominance

GC = General Conservatism

EC = Economic Conservatism

SC = Social Conservatism

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AUTHOR'S DECLARATION

At no time during the registration for the degree of Doctor of Philosophy has the author been registered for any other University award.

Work submitted for this research degree at the Plymouth University has not formed part of any other degree either at Plymouth University or at another establishment.

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Signed……

Date……...

CHAPTER ONE

INTRODUCTION

1.1 JUGAAD

"Only those who will risk going too far can possibly find out how far it is possible to go" — T.S. Eliot (1931)

I grew up in the northern parts of India, where in several sections of the society, there is abject poverty, scarcity of food and clean water for drinking. Children are often malnourished and people lack necessary resources to support their families. Frequently, such situations give rise to ingenious inventions or creative solutions to otherwise unsolvable problems. Arguably, Plato in the Republic said - "…a true creator is necessity, which is the mother of our invention" (Plato, circa_380 BCE). This idea truly comes to life in a socio-economic setting, like northern India where problems are grave and resources are scarce but raw materials are abundant. This creative process through which individuals solve their day-to-day problems is often called '*Jugaad*'. *Jugaad* is a colloquial Hindi word which can be roughly translated in English to a 'fix' or 'DIY'. More formally, it refers to "…an innovative fix; an improvised solution born from ingenuity and cleverness" (Radjou, Prabhu, & Ahuja, 2012). A typical *Jugaad* could be exemplified by the following:

1. reverse engineering an electricity generator to run a heavy truck,
2. using a clothes iron to boil a pot of water,
3. using a pressure cooker as an espresso machine by removing its safety valve, etc.

Perusing these creative solutions, one thing quickly becomes apparent. Most of them are dangerous and involve several forms of high risk taking. While a reverse engineered electricity generator could easily catch fire, an electric clothes iron in close proximity to water could electrocute or burn and a pressure cooker without a safety valve

could explode. These innovative fixes thus require individuals (and society in general), who are willing to take risks. In one of his writings, Sternberg proposed that some domains of risk taking appear to be more important for creativity than others. Thus, the present thesis investigated the role of domain specific risk taking in creativity.

1.1.1 General Overview Of The Thesis

Previous researchers have often speculated about the role of risk taking in creativity, however this association has rarely been systematically investigated. In this thesis, I investigated the association between domain specific risk taking behaviour and creativity in human participants.

The current chapter briefly introduces creativity and the most frequently used measures of creativity. This is followed by a short introduction to the approaches to investigate risky behaviour and a general understanding of risk taking. This chapter also summarises some of the widely-used task based as well as questionnaire based measures of risk taking. It then presents a systematic review of the speculations and scientific studies which were aimed (directly or indirectly) at uncovering the association between creativity and risk taking. From early speculations by McClelland to later systematic scientific explorations, this discussion aims to bring together the current knowledge centred around the link between risk taking and creativity. A section of this literature review is also devoted to a discussion of the studies which have examined the association between creativity and risk taking in specific domains such as ethical risk taking (often studied through deception or lying). This chapter finally presents the limitations of the previous approaches and opens new avenues for the studies detailed in the subsequent chapters.

Chapter two of this thesis begins with a detailed discussion of the limitations of the previous literature and lays out new approaches used in the studies presented in this thesis to mitigate some of these limitations. This chapter then poses two overarching

questions – (i) Are creative individuals risk takers? (ii) If so, is this association domain specific? Two studies aimed at answering these questions were employed in this investigation. Results from these studies revealed that creative individuals are risk takers in the social domain (but not in financial, ethical, health/ safety or recreational domains).

Inspired by the findings from chapter two, which highlighted the role of social risk taking in creativity, I aimed to further disentangle the association between creativity and risk taking in specific populations and social situations which are known to elicit significantly higher risk taking in a variety of contexts. Consequently, chapter three explores creativity in a specific group of individuals (Lesbian, Gay, Bisexual/ LGB+, sexual minority) who are speculated to be highly creative and are known to be more likely to take health/ safety risks such as smoking tobacco, consuming illegal drugs or engaging in unsafe sexual encounters. Although it has been particularly difficult in the past to accurately assess sexual orientation in scientific investigations, successful attempts involve using a holistic approach combining objective tasks and subjective reports. Using this approach, this chapter presents results from an eye tracking study and an online survey in order to explore the association between creativity and risk taking in sexual minority.

As opposed to the sexual minority, another group of individuals where risk taking is hypothesised to be lower consists of individuals who subscribe to the right-wing socio-political ideologies. This is a direct prediction of a theorised model (called dual process motivational model) which proposes that right-wing ideologies are formed due to a view of the world as a dangerous or a competitive place. These social worldviews in turn are a product of a punitive and/or unaffectionate childhood socialisation. These childhood socialisation practices, and the resulting worldviews might be at the base of differential risk taking behaviour in such individuals. An effect of this would lead to differential levels of creativity between individuals who subscribe to the right side of the socio-

political spectrum as compared to those who do not. This hypothesis finds support in a handful of previous studies investigating the effects of right-wing ideologies on creativity. Chapter four presents an extensive overview of the related literature, and discusses findings from a study which aimed to test these hypotheses. This chapter also presents a mediating role of social risk taking on the relationship between socio-political attitudes and creativity.

Finally, chapter five provides a comprehensive discussion, applications, expected contributions and future directions for the work presented in this thesis. This research work furthers our understanding of the factors that affect creativity and paves way for the development of new ways to foster creativity.

1.2 INTRODUCTION TO CREATIVITY

Many philosophers and writers in the past have defined creativity in their own words. From Bethune and Royce in 1800s to Guilford and Barron in mid 1900s, creativity has been defined using a variety of ways and expressions (Runco & Jaeger, 2012). Runco and Jaeger provided examples from literature to emphasize that it was Stein (1953) who provided the first unambiguous definition of creativity, which is now often referred to as a standard definition of creativity. According to Stein:

"*creative work is a novel work that is accepted as tenable or useful or satisfying, by a group in some point in time…*"

Thus, creativity has been noted to involve novelty (or originality) and usefulness (or appropriateness/value).

Creativity has been a subject of scientific discussion for many decades and is often seen in the light of these two related yet independent qualities (originality and usefulness). This definition of creativity provides the basis for the development of a wide variety of the standardized measures of creativity. Majority of these measures could be classified under the following three broad categories – (i) Tests that mainly involve a *controlled*,

divergent production of *appropriate* ideas some of which could be novel, and thus creative (I use the word *controlled* here in a restricted sense; it refers to a production of related ideas, not just any random idea); (ii) Tests that require the test taker to associate concepts in such a *remote* yet *appropriate* way that they guarantee novelty and thus qualify as creative (remoteness is determined by the rarity of association); and (iii) Biographical measures which aim to map relatively long term traits such as ideation or personality. Tests of creativity that are type (i) include (but are not limited to) tests like Alternate uses test (AUT), Torrance tests of creative thinking (TTCT), Guilford's consequences test (GCT), and so on. On the other hand, tests of type (ii) include Remote associates task (RAT), Insight problems, Match problems and so on. Finally, a number of biographical inventories have been developed which attempt to capture measures such as creative personality, creative achievement and creative ideation. These include, Gough's Creative Personality Scale (CPS; Gough 1979), Creative Achievement Questionnaire (CAQ) and Runco's Ideational Behavioural Scale (RIBS; Runco et al 2001). The measures of creativity that are employed in this thesis are detailed as follows.

1.2.1 MEASURES OF CREATIVITY

(i) Divergent thinking task:

The Alternate Uses Task (AUT) was developed in order to measure divergent thinking, a widely investigated behavioural dimension of creativity (Guilford, 1967). This task contains the names of several common household items (such as eyeglasses or a shoe) and participants are presented with these, one at a time. Participants are instructed to generate as many unusual uses as possible for the given household item. There is no limit on the time individuals take to record their responses; however, they are instructed to spend at least two minutes on each object. This time limit is carefully monitored by the experimenter. I administered the test using a computerized version of the test items and

hence instructed the participants to type in their responses using a keyboard. Items on this test included Key, Button, Wooden Pencil, Eyeglasses, Shoe and Automobile Tire.

(ii) Compound remote associates task (c-RAT):

The compound remote associates task is based on the original task by Mednick (1968), modified to provide a wide variety of remote associates problems (Bowden & Jung-Beeman, 2003). In each of these problems, participants are presented with three words which are associated with a common target word. The task for the participants is to find the target word. Every correct response increases the total score by one. Thirty items were selected for the present research from a set of 144 items provided in c-RAT. The remote associates problems can be filtered on the basis of difficulty or the time required to arrive at a solution. All of the items were randomly selected from a uniform distribution across all the difficulty levels. The task was presented on a computer and participants had 15 seconds to type in their responses in each trial. Solutions appeared as inter-trial intervals which were then followed by the next trial. Some of the items on this test include "Cottage/ Swiss/ Cake (target word is Cheese)", "Knife/ Light/ Pal (target word is Pen)", "Blank/ List/ Mate (target word is Check)" and "Mill/ Tooth/ Dust (target word is Saw)".

(iii) Creative Achievement Questionnaire (CAQ) and Runco's Ideational Behavioural Scale short form (RIBSs):

CAQ assesses creative achievement across ten different domains of creativity: music, visual arts, architecture, scientific discovery, culinary arts, dance, theatre and films, inventions, writing and humour (Carson, Peterson, & Higgins, 2005). It is a questionnaire based measure in which participants are asked to report their achievements in these ten domains. Sample items on the checklist include "I have no training or recognized talent in this area (Skip to next)", "My work has been critiqued in national

publications", "I have written an original long work (epic, novel, or play)" and "My choreography has been recognized by a local publication".

RIBSs is a questionnaire based measure of creativity which measures creative ideation (Runco, Plucker, & Lim, 2001). Participants are asked to report how frequently they generate ideas on a five-point scale (from never to daily) in response to nineteen different questions relating to their day-to-day ideas and ideation ability. Some of the items on the scale include "ideas for arranging or rearranging furniture at home" and "ideas for stories or poems".

(iv) Creative Personality Scale (CPS):

Creative Personality Scale is a checklist developed by Gough in order to identify individuals with the characteristics of a creative person Gough (1979). Gough identified a list of adjectives which comprise a creative personality and contrasted them with adjectives which do not. The creative personality scale presents participants with a set of thirty adjectives such as "Original", "Insightful" and "Confident". Participants indicate all the adjectives that apply to them via a checklist. These adjectives are then scored positively or negatively according to a standardized scoring key to calculate the composite creative personality score. Sample items on this checklist include Capable, Suspicious, Inventive, Reflective and Unconventional.

All tests or measures of creativity rely on a principal question – What constitutes a creative idea? In a scenario where an individual has generated a number of ideas, his/her ideas could be plotted as dots on a graph with an understanding that the farther away an idea is from the centre, the more unconventional (or original) the idea is going to be. This is the dimension of originality. An opposing dimension exists on this graph as the dimension of appropriateness. An individual can work within the boundary of this second dimension as long as the generated ideas are deemed appropriate by an individual, a group of people or a culture at a certain point in time. For instance, using a brick as a food item

is extremely novel and thus pushes the boundary of the novelty, however it is highly inappropriate (everywhere in the world!) and thus does not conform to the limits imposed by the boundaries of appropriateness. Given this graphical representation, creativity can be seen as the ability to find and reach the dots outside the boundary of the conventional ideas while staying within the boundary of appropriateness.

1.3 INTRODUCTION TO RISK TAKING

In a manner similar to creativity, it has been extremely challenging to define risk taking without making the concept too complex. Is the race driver driving a car at 200 km/hr a risk taker? Or is the beginner who is driving at 30 km/hr through a busy street a risk taker? Would someone be a risk taker if they are engaged in an activity unaware of the risk involved; for example, eating a meal with a carcinogenic element in it? On the other hand, is every kind of risk taking equally risky? For instance, does jumping off a tall bridge involve the same amount of risk as engaging in unprotected sex? Trimpop attempted to bring together elements from the previous literature in order to provide a comprehensive definition of risk taking (Trimpop, 1994). He defined risk taking as follows:

"*Risk taking is any consciously, or non-consciously controlled behaviour with a perceived uncertainty about its outcome, and/or about its possible benefits or costs for the physical, economic or psycho-social well-being of oneself or others*"

It is important to note that in this definition of risk taking, Trimpop discusses the differences in the types of consequences in different types of risk taking (physical, economic or psycho-social). This 'domain specificity' of risk taking is relatively understudied and the research presented in this thesis will emphasize the importance of exploring risk taking as a domain specific trait. Five different domains of risk taking are investigated in the present research: social, ethical, health/ safety, financial and recreational.

The measures of risk taking that are employed in this thesis are detailed as follows.

1.3.1 MEASURES OF RISK TAKING

(i). Roulette Betting Task:

The Roulette Betting task is an experimental task paradigm which was developed in order to capture financial risk taking, one of the most frequently studied form of risk taking (Studer & Clark, 2011). In this task, participants are presented with a wheel containing ten segments or 'pockets' on a computer screen. Each pocket is either red or blue coloured. Through verbal and written instructions, participants are informed that the blue pockets are associated with wins while red with losses. In each trial, they are presented with three boxes indicating the available bet options – low, medium and high. Participants are instructed to select one bet, and upon selection, the wheel spins for a variable amount of time (3-3.5s) before randomly stopping on one of the ten pockets. Finally, a text feedback indicates whether they won or lost the money. The ratio of blue to red coloured pockets determines the probability of winning. This probability is varied at three levels – small (40% chance of winning), medium (60%) and large (80%). The probabilities of rewards and magnitude of the bet options are randomized across all trials. In total, one-hundred trials are presented to each participant. Before the commencement of the task, they are informed that the highest score obtained by one of the participants on this task would be converted into a monetary donation to a local charity of their choice.

The Roulette Betting Task provides two measures of financial risk taking behaviour: (i) average bet amount across all the decision trials (average bet) provides a measure of financial (gambling) related risk taking, and (ii) rate of change of bets as a function of the probability of winning (slope of the best line of fit) provides a measure of adjustment to an increase in risk.

(ii). Domain Specific Risk Taking Scale (DOSPERT):

Risk taking behaviour has been traditionally measured solely by financial risk taking tasks (such as the Roulette Betting Task and the more widely used Iowa Gambling task (Bechara, Damasio, Damasio, & Anderson, 1994). Slovic argued that domains other than financial risk taking must be measured in order to obtain a comprehensive measure of risk taking behaviour (Slovic, 1964). This prompted Weber et al to develop DOSPERT, a standardised risk taking questionnaire which measures likelihood of risk taking in five different domains (Weber, Blais, & Betz, 2002). These domains include – Social risks, Financial risks, Health/ Safety based risks, Ethical risks and Recreational risks. Financial risk taking is further sub-divided into two sub-domains, Gambling and Investment risks. DOSPERT is a standardized questionnaire of risk taking attitudes and it contains thirty questions related to five different domains of risky behaviours (Blais & Weber, 2006). Each domain contains six questions and individuals rate the likelihood of engaging in risky activities on a seven point Likert scale ranging from 'extremely likely' to 'not likely at all'. Higher values on the scale represent higher chances of engaging in the risk taking. Sample items on the scale include "Disagreeing with an authority figure on a major issue" (social), "Passing off somebody else's work as your own" (ethical), "Driving a car without wearing a seat belt" (health/safety), "Bungee jumping off a tall bridge" (recreational) and "Betting a day's income at a high-stake poker game" (financial).

DOSPERT also measures perception of risk (from 'extremely risky' to 'not at all') and expected benefits (from 'great benefits' to 'no benefits at all') on seven point scales. 'Risk perception' responses measures individuals' gut-level assessment of risk. On the other hand, 'expected benefits' responses evaluate the degree of benefit that an individual see in each risky activity.

1.4 CREATIVITY & RISK TAKING

The great polymath Leonardo da Vinci risked his reputation and had lawsuits against him when he left his already established career in Florence to start a new life in

Milan. It is said that while painting 'The Last Supper' in Milan, he got annoyed by a nagging religious officer and threatened to use the officer's face as a model for the face of Judas in the painting. History of art is dotted with such examples of creative individuals who chose a radical, risky approach in their artworks when compared to their contemporaries. The association between creativity and risk taking has previously been speculated and explored scientifically in the literature.

1.4.1 WHY IS INVESTIGATING THIS ASSOCIATION IMPORTANT?

Creativity is indispensable for a society to thrive and evolve. Engineers and architects constantly strive to build stronger and bigger structures, molecular biologists find ways to design new and elegant drug delivery systems to fight deadly parasites and archaeologists employ previously unimagined technologies to find lost civilizations. In all these instances, it is important to generate new ideas and evaluate them. However, there is always a high risk involved in testing new ideas and presenting them for social evaluation, since the original ideas can be rejected, criticized or even mocked by others. A painter or a sculptor unveiling their artwork in a gallery, a chef serving a new dish using an exotic ingredient for the first time, a writer sending their collection of stories to the publisher or a dancer improvising on-stage, are prime examples of the socially risky situations. Systematic scientific investigations of the association between risk taking and creativity will allow us to expand our current understanding of the traits such as risk taking which might affect creativity. Consequently, it will pave way to create new environments and social situations, which might foster creativity in young individuals.

1.4.2 THEORIES AND SPECULATIONS

The earliest proposal of a possible association between creativity and risk taking was provided by McClelland (1956) in a research conference on the identification of creative scientific talent. As early as 1956, he proposed that 'a calculated risk' is an important aspect of scientific performance. His views were published later as a book

chapter in 1963 and became one of the primary source of reference for later researchers (McClelland, 1963). Getzels and Jackson (1962) discussed creative individuals and their risk taking behaviour in their book on creativity and intelligence. They proposed that the creative adolescent "seemed to enjoy the risk and uncertainty of the untried and the unknown" while the high IQ adolescent "seemed to…. shy away from the risk". Instead of the creative personality, Haefele (1962) commented on the creative act. He proposed that a creative act, "after all… is a risk". Similarly, based on her observations, Amabile (1996) indicated the directionality of the association between creativity and risk taking and wrote that it appears that "risk taking is essential for high levels of creativity".

Later reports have also frequently identified and suggested the existence of a link between creativity and risk taking. Sternberg and Lubart (1995) attributed the rarity of creativity in general, to the risk aversion in individuals. They speculated that since creative work often involves outcomes which could either be perceived as gains or losses, people tend to be risk-averse. They tend to work on ideas which are well developed and 'safe' to pursue. Thus, not only does risk taking, but also risk perception seems to play a role in creativity. Furthermore, Sternberg (1997) argued strongly for people to take some risks in order to foster creativity. He emphasized that 'successfully intelligent' people take sensible risks and encourage others to do the same. Gardner (2005) referred to his previous studies and suggested that personal aspects are more important than cognitive aspects in creativity and that if one is to "exhibit a creative mind, they must be comfortable in taking risks". Other writers have also expressed their views about the link between risk taking and creativity, albeit using slightly different words. For instance, Joubert (2001) observed that it is often through "creative risks that huge successes are achieved".

Similar references to risk taking can also be found in the relatively recent literature on creativity. Cropley and Cropley (2009) wrote about a possible explanation of the

association between creativity and risk taking. They speculated that more fundamental characteristics such as emotionallability or a greater sensitivity to changes in external stimuli may underlie traits such as risk taking and production of novelty (an important aspect of creativity). Similarly, Runco (2014) highlighted an important aspect of creative ideas; they are untested and hence risky to be considered or shared. He pointed out that the unconventionality of an idea renders it risky, "the more original an idea, the larger the risk". Thus, someone who is risk averse, is unlikely to generate, explore and share original ideas. He further called creativity a process which usually involves risk (Runco, 2015). Recently, while discussing the role of task motivation in creativity, Steele, McIntosh, & Higgs (2016) also described how task motivation can enhance idea generation by facilitating a willingness to take risks. Thus, after reviewing the literature, it is clear that over the last few decades, researchers have frequently speculated the existence of a link between risk taking and creativity. Often, these speculations and theories refer to the previously existing ideas and a small number of scientific studies. **Figure 1.1** provides a systematic network of how the relevant reports have been influenced by each other.

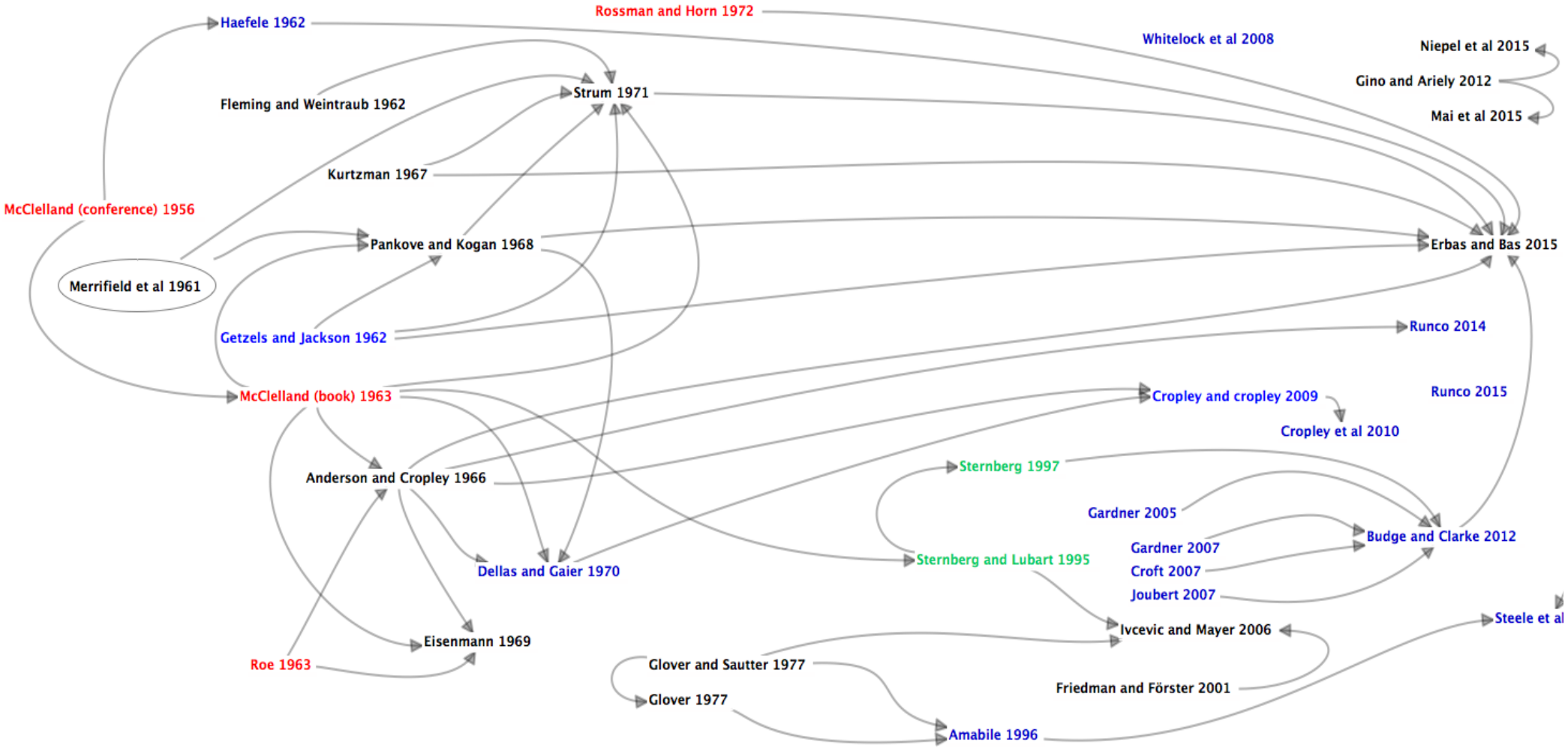


Figure 1.1 – A network of studies reporting a link between risk taking and creativity.

The studies are arranged in chronological order from left to right. Arrows point forward and represent an influence of a past study on later reports. References in the blue colour represent speculative reports, those in the black colour represent scientific investigations, those in the green colour reported both speculations and scientific results and those in red were inaccessible to the author.

1.4.3 REPORTS BASED ON EMPIRICAL EVIDENCE

Merrifield, Guilford, Christensen, & Frick (1961) were among the first group of researchers to report a small yet significant correlation between measures of risk taking and creativity. They designed an inventory to measure an array of variables and captured creativity using measures of divergent thinking such as associational fluency and originality. Divergent thinking tests are often used as measures of creativity, and require participants to come up with as many solutions to a given problem as possible (for instance, alternate uses of a shoe). Adventurousness served as a measure of risk taking. The results indicated that a significant correlation existed between associational fluency and adventurousness. The authors suggested that the participant must take risks in generating original responses since some of them may be rejected. It is worthwhile noting that their participant group consisted of Naval air cadets and it could be argued that the risk taking tendency was generally high in this group due to occupational demands. Based on McClelland's speculations, Anderson and Cropley (1966) designed an exploratory study to test the association. They used 'desire for certainty' as an indirect measure of risk taking, which involved asking the participants to rate their confidence in probability estimates concerning unknown, uncertain events. Divergent thinking tests served as measures of originality and consequently creativity. This study was conducted among seventh grade schoolchildren and it found that the children who scored high on originality were also significantly high on risk taking when compared to the children with low originality scores.

A criticism of the study by Merrifield et al was provided by Pankove and Kogan (1968). They argued that the validity of the measure of risk taking was doubtful and it was difficult to understand why only associational fluency (among other measures of divergent thinking) was correlated with risk taking. Consequently, in their study among

fifth graders, they employed three different measures of risk taking. These were – (i) Draw-a-circle, (ii) Clues and (iii) Shuffleboard. In Draw-a-circle, children were asked to draw a circle and then place a cross at the centre of the circle. It was assumed that the larger the circle, the easier it is for the children to place a cross at the centre, and hence smaller the risk of failure. The diameter of the circle was then used as a risk taking measure. In the Clues task, children were instructed to ask a number of clues to identify an unknown common object such as a baseball bat. Furthermore, they were told that a monetary prize would go to a child who correctly identifies the object using the smallest number of clues. The number of clues was thus used as a measure of risk taking. Finally, in the Shuffleboard task, children were asked to place two markers on a board and then shoot a penny between the two markers without touching the markers. The shorter the distance between the markers, the higher was the risk of failure. Additionally, verbal and pictorial tests of divergent thinking (Wallach-Kogan tests, 1965) were employed to measure creativity. They found that risk taking when measured by the Shuffleboard task was correlated with creativity. The other two measures of risk taking failed to demonstrate any significant correlation. The authors attributed the negative results in their study to the questionable validity of 'Draw-a circle' as a risk taking measure and to the high interpersonal competition in the 'Clues' task.

These mixed findings inspired later researchers to investigate risk taking in the context of creativity in diverse participant groups. For instance, Eisenman (1969) recruited undergraduates to measure risk taking. He employed two risky procedures to measure risk taking in these students. In one procedure, students were asked to let their grades on the first test decide the grades for the whole course; alternatively, they could reject the option. It was hypothesised that students who were more willing to take risks would choose to let the first test decide their overall grades. Academic ability (a general ability to score higher in tests) and demand characteristics (tendency to conform to

experiment's demands) were controlled by the experimenter. The second risk taking procedure was a gambling task with a possibility of losing personal money. Creativity was measured by a Personal opinion survey in this study. This paper-and-pencil measure of creativity claimed to measure personality components of creativity such as tolerance of complexity and tolerance of ambiguity. The author found that the participants who scored higher on the creativity inventory also engaged in more risk taking behaviour in both the risky procedures.

The studies discussed so far in this review were limited in various ways. Strum (1971) pointed out that these studies vary greatly in their definitions of creativity and risk taking, instruments used to measure each of the variables and participant demographics such as number, age, gender and background. On one hand, risk taking was measured by traits such as adventurousness, gambling and desire of certainty, while on the other hand creativity was measured using personality traits such as tolerance of ambiguity (personal opinion survey), associational fluency and originality. Keeping these limitations under consideration, Strum conducted a study among the fifth-grade children to investigate the association between academic risk taking and creativity. She measured creativity using divergent thinking tests developed by Torrance (1966). In order to capture risk taking, she presented children with forty-five vocabulary items. They were asked to correctly identify the item, and were awarded points with each correct answer. The number of points for each question were decided by the participants. However, equal number of points were deducted from their total score if they got the answer wrong. Thus, children who chose higher points in each question were considered high on risk taking behaviour. The researcher found that there were no significant differences between participants' fluency, originality, flexibility or elaboration scores in the high risk taking group when compared to the corresponding scores in the low risk taking group. These results were clearly contrary to the previous findings. This study raised questions on the validity of

the methods used to measure creativity and risk taking and called for a re-examination of the established tests.

Despite the concerns raised by Strum in 1971, later studies on risk taking and creativity were marred by similar limitations. For instance, a study investigating the components of creativity and their relationship with risk taking preferences in graduate students found that individuals who preferred higher risk taking, scored higher on originality and flexibility in the divergent thinking tests of creativity (Glover & Sautter, 1977). There were however, no differences in the fluency scores of individuals with preferences for high and low risk taking. Finally, elaboration scores were higher for individuals with low risk taking preferences. The authors acknowledged that the sample size was too low to draw any meaningful conclusions. Additionally, it is worth noting that yet another inventory was used in this study to measure risk taking.

Finally, recent studies have also employed a wide variety of measures to capture risk taking and creativity. In a recent study, academic risk taking and creativity were measured using academic risk taking scale and creative ability in mathematics test respectively (Erbas & Bas, 2015). The study reported that no significant correlation exists between the two measures. In a similar study, Ivcevic and Mayer (2006) measured three dimensions of creativity – creative life style, performing arts and intellectual achievement using a novel questionnaire. They used a subtest of Wallach-Kogan inventory in order to measure divergent thinking. On the other hand, monetary risk taking was measured by risk taking personality inventory. They found that individuals who score high on the intellectual achievements take higher monetary risks.

1.4.4 LIMITATIONS OF THE PREVIOUS LITERATURE

There are a wide variety of tasks and questionnaires available to capture creativity in individuals. Standardised measures of creativity range from personality, achievement based inventories and ideation measures to behavioural tasks measuring divergent

thinking and creative problem solving. Similarly, risk taking measures vary widely in their approaches; some measuring risk taking tendencies in various domains (Domain Specific Risk Taking Scale, Blais & Weber, 2006) while others are targeted at capturing specific risk taking behaviours (such as gambling tasks for financial risks (Bechara et al., 1994), deception scenarios for ethical risks (Gino & Ariely, 2012) or behavioural tasks for health and safety related risks (Lejuez et al., 2002)). Not only do the studies investigating creativity and risk taking use specific measures, they also often employ lesser used tasks and measures with questionable validity. More importantly, previous investigations have been motivated by a variety of objectives; some ranging from wide aims such as investigating personality and creativity, others by very specific aims such as investigating mathematical creativity and academic risk taking. This diversity thus makes it difficult for any strong conclusions to be drawn about the association between creativity and risk taking. **Table 1.1** provides an illustrated comparison of the previous studies, the corresponding demographics and the instruments used for measuring creativity and risk taking.

Table 1.1 – Demographics and measures used in previous investigations.

Author(s)	Year	Sample size	M_{Age}/Range (Years)	Measure(s) of Risk Taking	Measure(s) of Creativity
Merrifield et al	1961	164	NA, Adults	Inventory of non-aptitude measures measuring 'adventure'	Divergent Thinking measures - Fluency and Flexibility
Fleming and Weintraub	1962	68	8-12.5	Modified revised California Inventory measuring 'attitudinal rigidity'	Torrance Tests
Anderson and Cropley	1966	320	13.5	Extremity and Confidence in Judgment inventory measuring 'desire for certainty'	Guilford-Torrance Tests
Pankove and Kogan	1968	162	NA, Children	Tasks of risk taking – (i) Draw-a-circle (ii) Clues (iii) Shuffleboard	Alternate Uses and Pattern Meaning Task from Wallach-Kogan battery
Eisenmann	1969	62	NA, Adult College Students	Tasks of risk avoidance – (i) Gambling (ii) Risk-your-grades	Personal Opinion Survey
Strum	1971	291	10.5	Wide Range Vocabulary Test measuring 'academic risk taking'	Torrance Tests of Creative Thinking

Author(s)	Year	Sample size	M_{Age}/Range (Years)	Measure(s) of Risk Taking	Measure(s) of Creativity
Glover	1977	84	21	Choice Dilemma Questionnaire	'Unusual uses' and 'Ask & Guess' from Torrance Tests of creative Thinking
Glover and Sautter	1977	66	29	Choice Dilemma Questionnaire	'Unusual uses', 'Ask & Guess', 'Product Improvement', 'Unusual questions' and 'Just suppose' from Torrance Tests of creative Thinking
Friedman and Förster	2001	126	NA, Undergraduates	Novel Maze Task	Snowy Pictures Test as a measure of Insight and Alternate Uses Task as a measure of divergent thinking
Ivcevic and Mayer	2006	416	17-22	Risk-Taking Personality Inventory measuring 'monetary risk taking'	Instances subtest from Wallach and Kogan battery, Novel questionnaire measuring 'creative life style', 'performing arts' and 'intellectual achievement'
Erbas and Bas	2015	217	15	Academic Risk Taking Scale	Creative Ability in Mathematics Test measuring 'mathematical creativity'

NA = Not available

To sum up, it is evident that very little is known about the association between creativity and risk taking. Experiments investigating the specifics of this association are required to understand the nuances of how these two behavioural traits might be linked. Despite many systematic attempts at studying risk taking in the context of creativity in the past, it has been extremely difficult to draw any significant conclusions. This is mainly due to the multidimensional nature of both creativity and risk taking. Creativity is a personality trait and a process which is governed by a plethora of factors such as motivation, amount and type of rewards, available information, past experience, social surroundings and so on. Similar factors are known to govern risk taking behaviour in individuals. It is thus intuitive to investigate these factors influencing both creativity and risk taking using a diverse range of available measures. The current thesis benefitted from this approach which has been recommended numerous times in the previous literature on creativity (Cropley, 2000; Eisenman, 1969; Fields & Bisschoff, 2013). Previous literature has also been marred with limitations pertaining to the demographics such as low statistical power, large differences in participants' age, specific gender groups, differences in academic and personal backgrounds and so on. Research presented in this thesis thus utilized large (age and gender diverse) sample sizes with diverse social, academic and cultural backgrounds.

1.5 CREATIVITY AND DOMAIN SPECIFIC RISK TAKING

In the current discussion, it is pertinent to talk about a small group of studies which did not aim to explore the association between risk taking and creativity in general, however they have investigated specific domains of risk and their association with creativity. Deception, an example of ethical risk taking, involves telling lies and submitting false information to obtain certain rewards. Previous studies have indicated the presence of a positive association between ethical risk taking and creativity.

In an elaborate study, Gino and Ariely (2012) measured creative personality using three different measures: Creative personality scale, Creative behaviour inventory and Creative cognitive style scale. Additionally, they measured levels of dishonesty using three different tasks. In the problem-solving task, participants were asked to solve a number of problems on a paper based test, then throw the paper in the recycling bin and report their performance to receive a reward, thus giving them an opportunity to lie. Similarly, in a general knowledge quiz, participants were provided with a set of general knowledge questions in a question sheet and asked to mark their answers from the given choice options. They were then requested to copy over their responses in a separate bubble sheet and bin the question sheet. They were also informed that due to a mistake, the experimenter lightly marked correct answers in the bubble sheet, thus providing them with an opportunity to cheat. Finally, in the perception task, participants were asked to judge and report the side of the screen (left or right) where a higher number of dots appeared on the screen. They received higher rewards for the decisions made on the right side than the left, thus motivating them to cheat by choosing the right side more frequently. The researchers reported that the levels of dishonesty in all the tasks were significantly correlated with creative personality scores from all the measures.

In a follow up experiment, Gino and Ariely (2012) primed the participants to have a more creative mind-set by employing a scrambled sentence test. In this test, participants were presented with a set of words and their task was to construct grammatically correct four word sentences. The creative priming condition was induced in one half of the participants by including words related to creativity such as new, novel, creative, original and so on. The other half of the participants did not receive these prime words and thus belonged to the control group. Using the aforementioned problem solving task of deception, the researchers found that activating the creative mind-set led the experimental group to deceive significantly higher than the control group. The researchers thus

concluded that creativity promotes dishonest behaviour in an ethical dilemma. Gino and Wiltermuth (2014) investigated this causal relationship in the opposite direction using a similar set of measures and found that unethical behaviour can also lead to greater creativity.

Despite these findings, later studies have questioned the validity of some of these results. For instance, Niepel, Mustafić, Greiff and Roberts (2015) pointed out that in the study by Gino and Ariely, not only were participants presented with an opportunity to behave dishonestly, they were tempted to do so. Thus, it could be that in their experimental design, unethical decision making was a norm which could have led to the reported results. Niepel et al conducted a longitudinal study on unethical behaviour and creativity in student samples. Using self- and teachers'-ratings of creativity and ethical decision making, collected over a one-year time period, the researchers reported that creativity was not a general predictor of ethical decision making. These mixed findings thus allow for a limited inference to be drawn. The present research thus aimed to resolve these contradictions by investigating the relationship between creativity and risk taking in a domain specific manner. Investigating risk taking as a domain specific trait is important since much like creativity, risk taking is often studied as a domain general trait while a significant section of the literature points towards domain specificity in both of these variables. Exploring the relationship between creativity and other specific domains of risk taking is also in line with Sternberg's proposal (1997) that specific type of risks might be more pertinent to creativity (for instance social risks) than others (such as those that endanger limbs and life).

1.6 CONCLUSION

The association between risk taking and creativity has been a source of scientific investigations and speculations among many scholars for decades. Despite the investigations and theories, the evidence that supports this association is mixed and

inconclusive. This chapter systematically reviewed the theoretical and scientific proposals of an association between creativity and risk taking. It then shed light on the limitations of the available literature and presented new avenues for studies using a holistic, domain specific measurement of creativity and risk taking. The studies presented in this thesis aim to utilise these methods to unravel nuances of the association between creativity and risk taking. Such investigations of risk taking in the context of creativity might play a crucial role in building educational and social environments with a potential to promote creative output.

1.7 STATISTICAL NOTE

The main feature of interest was to investigate the relationship between risk taking and creativity. In order to achieve this, linear Bayesian correlation analysis was conducted on the data. This yielded Pearson's correlation coefficients (r) and Bayes factors (BF_{10}) as the test of statistical support (analogous to p values in frequentist tests of significance). When investigating the association between two variables, Bayesian correlation analysis has clear advantages over the classical correlation analysis method and this is discussed in greater detail in chapter two. Studies presented in chapter two further rely on multiple linear regression analyses using the 'Stepwise' and 'Enter' methods to determine the influence of various domains of risk taking on creativity. Group differences across various sexual orientation groups in chapter three as well as across various political parties in chapter four were tested using one-way analyses of variance. For datasets where parametric tests could not be used (for cases with violation of statistical assumptions), Kruskal-Wallis tests were used. In cases where either of the omnibus test of variance demonstrated statistical significance, post hoc tests were performed to determine group differences. These include Tukeys test for parametric data analyses and Dunns test for non-parametric data analyses. In both chapters three and four, theoretical models were tested using path analyses which include mediation and moderation analyses. Finally,

standardised effect sizes are reported throughout the thesis (η^2, Pearson's *r*, ratio of indirect to direct effect etc.) along with the tests of statistical support (p values, Bayes Factors and class intervals).

Throughout this thesis, the format recommended by the American Psychological Association is used to report statistical findings, present figures and tables. This include reporting exact p values rounded off to three decimal places and as 'p < 0.001' for very low p values. Similarly, for Bayes factors, exact BF_{10} are reported as opposed to BF_{01}. The statistical significance and supported levels were labelled accordingly:

$p < 0.05$ *

$p < 0.001$ **

$BF_{10} > 30$ *

$BF_{10} > 100$ **

CHAPTER TWO

THE 'RISKY' SIDE OF CREATIVITY: SOCIAL RISK TAKING IN CREATIVE INDIVIDUALS

2.1 RISK TAKING AND CREATIVITY

The great sculptor, painter and architect, Michelangelo frequently depicted the sensual form of human bodies in religious contexts such as in his masterpiece, 'David'. In one incident, his fresco, 'The last judgment' was highly criticized by the then Pope's master of ceremonies since it "depicted…nude figures, exposing themselves" (Land, 2013, p. 15). Michelangelo responded by painting the official's face into the mural and covering his nude figure with a snake. Anecdotes such as this have provided support for the notion that creative individuals are risk takers. In his seminal work, McClelland proposed that 'a calculated risk' is an important aspect of scientific performance (McClelland, 1963). Other writers have expressed similar views (Runco, 2015; Steele et al., 2016; Sternberg, 1997; Sternberg & Lubart, 1995), calling a creative act a risk (Haefele, 1962), as well as referring to the willingness of creative individuals to risk the uncertainty of the unknown (Getzels & Jackson, 1962). Despite these suggestions, most of the literature is speculative in nature and little empirical data exists to support such claims. To bridge this gap, I investigated whether risk taking is associated with creativity; more importantly, I specifically examined the link between creativity and risk taking in five different domains or content areas.

As evidenced from the literature review in the previous chapter, over the years, there have been numerous attempts at investigating the association between risk taking and creativity. Some of these explorations yielded an evidence of a positive correlation between risk taking and creativity (Ivcevic & Mayer, 2006; Kurtzman, 1967; Merrifield et al., 1961) while others reported either a negative correlation (Fleming & Weintraub,

1962; Pankove & Kogan, 1968) or an absence of a correlation (Erbas & Bas, 2015; Nicolay, 1966). Past research has utilized participant groups which were mostly based on children (fifth graders, elementary school children, ninth graders etc.) and a few on adults (Coast guards, Naval and Air Force Cadets, undergraduate students). Keeping age differences aside, these studies were also varied in the gender of the participant groups (some were exclusively male, some exclusively female, others mixed). Finally, these studies also employed a wide variety of (usually low-reliability) tasks and measures of both creativity and risk taking. Most frequently, these tasks or questionnaire based measures assessed a specific dimension of creativity or risk taking (such as divergent thinking or adventurousness respectively) rather than the general trait.

The aforementioned studies clearly demonstrate a lack of consensus regarding the relationship between risk taking and creativity. Some report a small positive correlation while others find no significant relationship between various measures of creativity and risk taking. As pointed out by Strum (1971), this lack of consensus may be attributed to the specific methods used to measure creativity and risk taking, diversity in the definition of creativity and risk taking, differences in the number of participants and other aspects of demographics, including cultural differences. Such varied and differentially motivated research warrants an obvious, yet important question: Are creative individuals high risk takers?

2.2 THE CURRENT APPROACH

In order to answer the aforementioned question and to address earlier shortcomings, in the current investigation I used a wider range of standardized performance and questionnaire based instruments to obtain comprehensive measurement of creativity and risk taking. Measuring creativity has been an exceptionally challenging task throughout the history of creativity research. Although numerous attempts have been made to measure different dimensions of creativity, they are marred with criticism. Past

studies which aimed to explore the relationship between creativity and risk taking have equated creativity to measures such as associational fluency, divergent thinking, tolerance of ambiguity, creative lifestyle or intellectual achievements. Each of these measures only provide a narrow insight into some aspects of creativity. Contrary to the previous studies, I treated creativity as a multidimensional trait and used both biographical and behavioural measures of creativity (creative personality, creative achievements in multiple domains, creative ideation, problem solving and divergent thinking) in large participant populations, including both student and non-student samples under different test conditions. This holistic approach is in line with recent studies advocating the use of a large, diverse group of measures to capture creativity (Cropley, 2000; Eisenman, 1969; Fields & Bisschoff, 2013). I propose that given the multidimensional nature of creativity, a holistic measurement will be more effective in capturing this construct.

In conjunction with the creativity measures, a gambling task called Roulette Betting Task (RBT) was employed to measure risk taking (Studer & Clark, 2011). This task has been shown to be a simple yet effective tool for measuring variables related to risk taking. However, while the gambling tasks provide an effective method of identifying risk taking in the financial domain, they do not guarantee that the resultant measures are applicable more generally. Indeed, to better capture the complex nature of risk taking, several researchers have argued for the need to measure risk taking in several domains. Slovic (1964), one of the early advocates of this idea, questioned the assumption that financial risk taking is a robust predictor of other types of risk taking. Following Slovic's idea, other researchers have developed measures intended to examine risk taking tendencies in more than one domain. Weber, Blais and Betz (2002), investigated risk taking in more than five hundred undergraduates and confirmed the presence of domain specificity in risk taking. They identified five domains of risk taking and developed a questionnaire called *DOSPERT* (*Domain Specific Risk Taking Questionnaire*) based on

their results (Blais & Weber, 2006). There is now sufficient evidence, from studies with diverse populations (Hanoch, Johnson, & Wilke, 2006; Rolison, Hanoch, Wood, & Liu, 2014), to support Slovic's argument, demonstrating the need to investigate risk taking across multiple domains.

Domain specificity is particularly relevant for our understanding of risk in relation to research in creativity because risk taking in some domains appears to be more pertinent to creativity than others. For example, it is possible that some domains of risk taking (such as social or recreational) are more closely associated with creativity than others (for instance, gambling). Sternberg (1997) provided support to this notion by referring to the importance of 'sensible' risk taking in creativity. He emphasized that the risk of being 'different' is more important in creativity than risks that endanger limbs or life. In line with these views, the current study aimed to systematically investigate the association between domain specific risk taking and a holistic measurement of creativity. I predicted that specific domains of risk taking such as social risk taking (i.e. the willingness to challenge norms) would show a positive association with creativity. I investigated these associations in a laboratory-based study which included behavioural and questionnaire based measures of creativity and risk taking. This was followed by an online study with a larger and more diverse group of individuals in order to explore the wider validity of the findings. To our knowledge, this is the first study to systematically investigate the relationship between domain specific risk taking and creativity.

2.3 STUDY 1

All the data for the first study were collected under laboratory based conditions from participants based in the UK.

2.3.1 METHOD

2.3.1.1 Participants:

Sixty-four volunteers (34 female, M_{age} = 23 years, SD = 4.36), were recruited from a paid participant pool and via posters across the university. The participants were White (82%), Black/Black British (7.5%), Asian/Asian British (3%) or they belonged to mixed ethnic groups (7.5%). All participants were paid £8 for their participation. The study was conducted in accordance with the declaration of Helsinki and received ethical approval from the research ethics committee at the researcher's university.

2.3.1.2 Measures of risk taking:

The measures of risk taking that were employed in this study included (i) Roulette Betting Task, and (ii) Domain Specific Risk Taking Scale (DOSPERT).

2.3.1.3 Measures of creativity:

The measures of creativity that were employed in this study included (i) Divergent thinking task, (ii) Compound remote associates task (c-RAT), (iii) Creative Achievement Questionnaire (CAQ), (iv) Runco's Ideational Behavioural Scale short form (RIBSs), and (v) Creative Personality Scale (CPS).

2.3.1.4 Self-reports:

In addition to the tasks and questionnaires, participants were asked to rate themselves on 'how creative they are' and 'how risk taking they are' on five point Likert scales.

2.3.1.5 Stimuli and Procedure:

Picture stimuli for the behavioural tasks were generated using an open source image editing software GIMP v2.8 (*www.gimp.org*). Text based stimuli were generated within an open source, Python based task presentation software, Psychopy2 (Peirce, 2007; Peirce & Peirce, 2009). Stimuli for the Roulette Betting Task included a roulette wheel with ten segments randomly coloured either red or blue. Stimuli for the divergent thinking task and compound remote associates task were directly taken from standardized

versions of these tasks and were used without any modifications. All the tasks were presented using Psychopy2. Questions and ratings for all the questionnaires were presented in an online survey web service (SurveyMonkey Inc., Palo Alto, California, USA, *www.surveymonkey.com*).

All the tasks and questionnaires were spread across two, one-hour sessions for each participant. Each session consisted of tasks followed by questionnaires. The questionnaires were always presented after all the tasks; however, the order of tasks and questionnaires were randomized across participants. All the questionnaires were administered as online surveys with no restriction on time.

2.3.1.6 Data Analysis:

The roulette betting task provided two measures of financial risk taking behaviour. The average bet amount across all the decision trials provided a measure of financial-gambling related risk taking for each participant (average bet). The change in bet amounts as a function of the probability of winning (the slope of the best line of fit), provided a measure of adjustment to risk (gambling risk adjustment). For creative thinking tasks, standard measures of analysis were used. The divergent thinking task allowed a measurement of originality and fluency; originality was the average statistical infrequency of the ideas and fluency score was the total number of ideas generated by each participant. Scores on the compound remote associates task were obtained by a summation of all the correct responses.

All the questionnaire scores were calculated using standard scoring keys and scoring procedures provided with respective questionnaires. I followed the suggestions provided in Silvia, Wigert, Reiter-Palmon and Kaufman (2012) and calculated nominal scores for each domain in the CAQ in order to avoid conducting further statistical analysis on skewed raw scores. The threshold for calculating the nominal scores were 0 (= 0), 1 to10 (= 1), and more than 10 (= 2). A total CAQ score across all the domains was used in

subsequent analyses. CAQ provided a creative achievement score while RIBSs provided a score of ideation fluency. Finally, DOSPERT provided scores for risk taking in each of the five risk domains.

Performance on all the tasks and scores from questionnaires were entered in a multiple correlational analysis where each factor was pairwise correlated with all the other factors.

2.3.1.7 Bayesian data analysis approach:

I chose to perform Bayesian correlation analysis on this data since it allowed the computation of the probability of both null (Bayes Factor BF_{01}) and alternate hypothesis (Bayes Factor BF_{10}) testing.

Bayesian statistical data analysis and inference approach relies on the principle of Bayes theorem. In probability theory, Bayes theorem describes the conditional probability of the occurrence of an event, based on the prior knowledge of all the conditions that might affect the occurrence of that event. For instance, Bayes theorem can be used to derive the chance of the occurrence of rain today in the south-west of England, given the past knowledge about the weather patterns. This past knowledge may include the occurrence of rain in this region, level of humidity, air pressure and so on. When overlaid on the correlational statistical analysis of data, Bayes theorem can be used to calculate the confidence with which a positive (or negative) correlation exists between two variables. This confidence is referred to as the Bayes factor (BF) in the Bayesian correlation analysis approach to data analysis and inference. Bayesian correlation analysis can be used to calculate the confidence of both the null hypothesis (BF_{01}, correlation does not exist) and alternate hypothesis (BF_{10}, correlation does exist). Bayesian correlation analysis has a clear advantage over the frequentist approach. Unlike the p values for correlations in the frequentist approach, Bayes factors for the null hypothesis and those for the alternate hypothesis are complementary to each other. In other words, the multiple

of BF_{01} with BF_{10} is always equal to 1 (the chance of one of them happening is always 100%; either there is a correlation or there is not). Thus, the higher the probability that there exists a correlation (BF_{10}), the lower the probability that there is no correlation (BF_{01}). As a rule of thumb, only BF_{10} is reported in the findings, since the aim of this analysis often is to find the existence of a correlation.

In order to interpret the results, I followed Jeffreys' suggestions (Jarosz & Wiley, 2014; Jeffreys, 1961), which provide an easy to interpret table of Bayes factors. In short, Bayes factor (BF_{XY}) from 10-30 suggests a strong evidence for X; BF_{XY} from 30-100 suggests a very strong evidence for X and BF_{XY} greater than 100 is decisive for X. I used a stringent threshold of Bayes factors higher than 30 for determining the very strong evidence in favour of the presence of correlations. Moreover, a non-informative, uniform prior with a beta prior width of 1 was used throughout the analysis. An open source statistical analysis software called JASP (JASP Team, 2016) was used to conduct all the statistical analyses.

2.3.2 RESULTS

Fluency and originality scores on the divergent thinking task did not significantly correlate with either task based or DOSPERT based measures of risk taking ($BF_{10} < 3.5$ for average bets, adjustment of bets, social, ethical, financial, health-safety and recreational risk likelihood, perception and benefits). There were also no significant correlations between scores of divergent thinking and other measures of creativity ($BF_{10} < 1.6$ for CPS, RIBS and CAQ). Similarly, c-RAT scores did not show any significant correlations with either measures of risk taking ($BF_{10} < 0.4$) or with other measures of creativity ($BF_{10} < 0.43$).

A paired samples t-test was conducted to compare the average bet placed in each probability condition. I found a significant linear increase in the average bet as the probability of winning increased (**Figure 2.1**). There was a significant difference in the

average bets placed in 40% (M_{bets} = 26.26, SD = 8.36) and 60% (M_{bets} = 45.17, SD = 12.60) probability trials (t(63) = -12.27, p < .001) as well as between 60% and 80% (M_{bets} = 70.21, SD = 11.94) probability trials (t(63) = -14.58, p < .001).

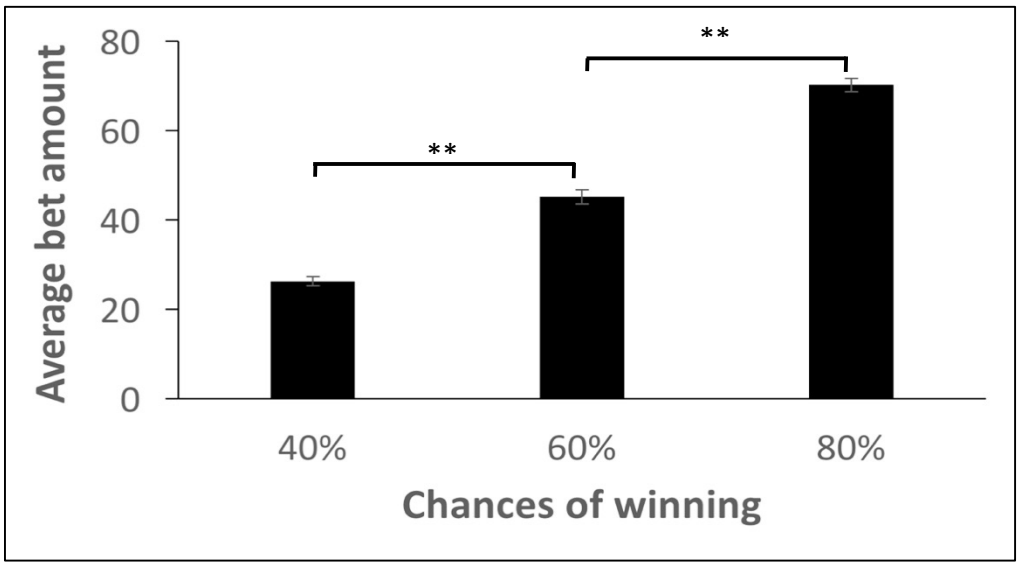


Figure 2.1 – Adjustment to risk

*Average bets selected showed a linear increase as the probability of winning increased (**p < 0.001 in a pairwise t-test).*

Neither measure of financial risk taking behaviour as measured by the gambling task showed significant correlations with any measure of creativity (BF_{10} < 0.6 for CPS, RIBS, CAQ, Fluency and Originality scores). Similarly, there was a lack of significant correlation between the likelihood of risk taking in the financial-gambling domain as measured by DOSPERT and the available measures of creativity (BF_{10} < 2.6). Following the same trend, I found that the likelihood of risk taking in recreational, financial-investment, health & safety and ethical domains also showed no significant correlations with measures of creativity (BF_{10} < 2.1). In contrast, scores on CPS (Pearson's r = 0.42, BF_{10} = 49.4), CAQ (Pearson's r = 0.46, BF_{10} = 233.14) and RIBS (Pearson's r = 0.4, BF_{10} = 32.19) were significantly correlated with the likelihood of risk taking in the social domain (**Table 2.1**).

Table 2.1 – Domain specific risk taking and creativity: study 1

	Gambling		Likelihood of taking risks					
Creativity	**Average bets**	**Risk adjustment**	**Social**	**Recreational**	**Financial (Gambling)**	**Financial (Investment)**	**Health & Safety**	**Ethical**
CPS	***-.01***	***-.007***	***.42****	***.22***	***-.04***	***.03***	***.18***	***.18***
	0.16	0.16	49.4	0.675	0.163	0.16	0.422	0.403
CAQ	***-.09***	***.02***	***.47****	***.24***	***.10***	***.18***	***.20***	***.18***
	0.2	0.16	233.149	0.943	0.215	0.408	0.524	0.422
RIBS	***-.20***	***-.11***	***.40****	***.18***	***.27***	***.29***	***.29***	***.28***
	0.55	0.22	32.195	0.436	1.511	2.073	2.143	1.947

Correlation table with Pearson's correlation coefficients (in bold, italics) and their respective Bayes factors underneath them. Statistically significant correlations are marked (BF_{10} > 30, **BF_{10} > 100). CPS=Creative Personality Scale, CAQ=Creative Achievement Questionnaire, RIBS=Runco Ideational Behavioural Scale.*

Perception of risks and expected benefits were not significantly correlated with CPS, CAQ or RIBS in any domain of risk taking (BF_{10} < 1.7). Only exception to this trend was a significant correlation between CAQ scores and expected benefits in the social domain (Pearson's r = 0.45, BF_{10} = 162.7).

2.3.3 DISCUSSION

The results from this study demonstrate a strong link between risk taking in the social domain and personality and biographical inventory based measures of creativity. Other domains of risk taking were not significantly associated with any measure of creativity. Social risk taking is particularly interesting to investigate in the context of creativity. Creative individuals often present their ideas and creative products to social groups, for evaluation, appreciation or criticism. This activity involves a high level of social risk especially since it entails the possibility of the creative idea or product being rejected by some, or all the individuals forming the social group.

Most participants reported that cRAT was extremely difficult and that they could not solve most cRAT problems in the time limit of 15 seconds. This was reflected in their scores, the maximum number of problems solved was fifteen (out of thirty). Accordingly, cRAT scores were removed from the subsequent analysis. Surprisingly, despite the widespread use of divergent thinking tasks as a proxy measure of creativity, divergent thinking scores showed no supported correlation with measures of risk taking and they were also not correlated with other measures of creativity. These results add to a plethora of literature questioning the appropriateness of the established divergent thinking based measures of creativity.

2.4 STUDY 2

Given the relatively smaller sample size and homogeneous group of participants in study 1, it is possible that participants' creative achievements, ideation and personality were restricted by their experiences. Consequently, I ran a second study on a large and more diverse group of participants living in the USA.

2.4.1 METHOD

417 participants (M_{age} = 36 years, SD = 12.26, 223 female) took part in this study for monetary compensation on a popular survey platform called Mechanical Turk (Buhrmester, Kwang, & Gosling, 2011). The participants were white (77.7%) while other ethnicities included African American/Black (8.3%), Asian American/Asian (6%) and other ethnic groups (8%). They came from diverse economic backgrounds, assessed by the self-reports of annual income with following categories – under $15,000 (11%), $15,000-$30,000 (16.3%), $30,000-$45,000 (23.2%), $45,000-$60,000 (19.6%), $60,000-$75,000 (10.3%) and above $75,000 (19.4%). Similarly, the participants reported a diverse academic background as measured by the highest education levels ranging from less than a high school graduate to a doctoral degree.

This study incorporated CAQ, RIBSs, CPS, DOSPERT and self-reports. It was self-paced and on average lasted for less than thirty minutes. In a manner similar to study 1, I performed a multiple pairwise correlation analysis. Additionally, I was interested in investigating the degree to which risk taking in each of the five domains would predict measures of creativity. All the scores from the questionnaires and self-reports were included in the correlation analysis which consequently informed the regression model.

Three regression models were built with five domains of risk taking as the predictors and the three measures of creativity as the predicted variables. All the multiple regression models were linear. Two methods of entering the predictors in the linear regression equation were adopted. The first method involves entering all the predictor variables simultaneously in the equation. This allowed an unbiased analysis of the contribution of each predictor (domains of risk taking) in predicting the measures of creativity. The second method involves a step wise introduction of each predictor in the linear regression equation. This method allows an accurate analysis of the effect of each predictor on the predicted variable. Finally, additional analysis was performed in order to find the effect of gender on creativity.

2.4.2 RESULTS

There were no differences between male and female groups on any scale of creativity. A multiple pairwise Bayesian correlation analysis showed that self-reports of risk taking showed strong evidence of correlations with the likelihood of risk taking in all the domains ($BF_{10} > 30$ for all domains, Pearson's r for social = 0.22, recreational = 0.54, financial/gambling = 0.35, financial/investment = 0.41, health/safety = 0.42, ethical = 0.37). Additionally, self-reports of risk taking were correlated with self-reports of creativity (Pearson's r = 0.31, $BF_{10} > 100$), CPS (Pearson's r = 0.29, $BF_{10} > 100$) and RIBS (Pearson's r = 0.31, $BF_{10} > 100$) (**Table 2.2**).

Measures of creativity and that of risk taking showed satisfactory internal consistency (Cronbach's alpha for RIBS = .89, CPS = .77, CAQ = .62, social likelihood = .76, recreational likelihood = .84, financial/gambling likelihood = .91, financial/investment likelihood = .82, health/safety likelihood = .75 & ethical likelihood = .78). Pairwise correlations for a linear relationship of the likelihood of social risk taking with CPS and RIBS demonstrated strong statistical evidence (**Table 2.2**). The likelihood of taking recreational risks was found to show supported correlations with all three measures of creativity while financial (investment) related risk was correlated with CPS and RIBS. None of the measures of creativity showed a supported correlation with risk perception in any domain ($BF_{10} < 4.2$). Similarly, CPS did not show any supported correlation with expected benefits in any domain ($BF_{10} < 0.6$). Finally, RIBS showed supported correlations with expected benefits only in the social (Pearson's r = 0.26, $BF_{10} > 100$) and recreational domain (Pearson's r = 0.25, $BF_{10} > 100$).

Table 2.2 – Domain specific risk taking and creativity: study 2

Creativity	Risk	Likelihood of taking risks					
Measures	**Self-reports**	**Social**	**Recreational**	**Financial (gambling)**	**Financial (Investment)**	**Health & Safety**	**Ethical**
CPS	***.29***	***.33***	***.26***	***.03***	***.24***	***.13***	***-.003***
	4.917e +6	1.500e +9	118945.7	0.074	13533.62	2.129	0.061
CAQ	***.16***	***.15***	***.20***	***.13***	***.16***	***.16***	***.14***
	9.484	6.141	228.7	2.095	15.35	14.95	3.385
RIBS	***.31***	***.29***	***.26***	***.22***	***.25***	***.21***	***.14***
	6.857e +7	6.972e +6	88645.4	1753.16	55209.14	677.956	2.922

*Correlation matrix with Pearson's correlation coefficients (in bold, italics) and their respective Bayes factors underneath them. Statistically significant correlations are marked (**$BF_{10} > 100$). CPS=Creative Personality Scale, CAQ=Creative Achievement Questionnaire, RIBS=Runco Ideational Behavioural Scale.*

I ran three linear regression models each predicting creative personality (CPS), ideation (RIBS) and achievements (CAQ) using the likelihood of risk taking in each of

the domains as predictors. The method used to build these models involved entering all the domains of risk at the same time. Additional stepwise methods of entering the domains of risk yielded the same result. Only the likelihood of risk taking in the social domain significantly predicted both creative personality and ideational ability [CPS: $F(6,410) = 12.83$, $p<0.001$, $R^2 = 0.16$, standardized coefficient for social risk taking = 0.237, $p<0.001$; RIBS: $F(6,410) = 12.05$, $p<0.001$, $R^2 = 0.15$, standardized coefficient for social risk taking = 0.243, $p<0.001$]. None of the other domains of risk taking were significant predictors of these creativity measures. None of the domains of risk taking predicted CAQ scores significantly [$F(6,410) = 4.04$, $p<0.001$, $R^2 = 0.06$, social $p = 0.076$, recreational $p = 0.12$, financial 0.39, health-safety $p = 0.97$ & ethical $p = 0.56$].

2.4.3 DISCUSSION

Results from this study corroborated the results from study 1, thus confirming a clear association between social risk taking and personality and biographical inventory based measures of creativity. Interestingly, additional correlations were observed with other domains of risk taking in this study such as recreational, financial and health-safety. Notably, the coefficient values for correlations between social risk taking and CPS as well as with RIBS decreased and stabilized in this study due to an increase in the sample size. This effect has been investigated in greater detail in previous studies. For instance, Schönbrodt and Perugini (2013) showed that for smaller sample sizes (such as in study 1), Pearson's coefficients fluctuate considerably and sometimes even change signs. However, with increasing sample size, the correlation coefficients decrease until they finally stabilize at a sample size of 200-250. Therefore, the larger sample size in study 2 provided confidence required for the statistically supported results. Moreover, a multiple linear regression analysis showed that only social risk taking is a significant predictor of the ideation and personality based measures of creativity. Other domains of risk taking did not predict any measure of creativity in this study.

2.5 GENERAL DISCUSSION

"*I am always doing that which I cannot do, in order that I may learn how to do it*".

This quote by the creative polymath Pablo Picasso is one of the many, that identifies the importance of taking risks in creativity. Previous scientific literature investigating the association between creativity and risk taking has reported mixed findings, mainly due to the differences in the size and type of participant sample and the specific instruments employed to measure risk taking and creativity (Strum, 1971). Most of these studies have reported measuring related but indirect variables; for instance, adventurousness for risk taking and divergent thinking for creativity. Previous reports have also been limited by their differentially motivated approaches; many sought out to investigate factors such as personality traits (Ivcevic & Mayer, 2006), promotion and prevention cues (Friedman & Förster, 2001), academic risk taking (Strum, 1971) or mathematical creativity (Erbas & Bas, 2015). In contrast, the current investigation was aimed at investigating the relationship between risk taking and creativity using a variety of behavioural, biographical and personality based measures. The motivation for the current study specifically led to the following question – Is risk taking generally associated with creativity or is this association domain specific?

The results from the first study indicated that among the six domains of risk taking, only social risk taking shows strong evidence for correlations with creative personality scale, ideation and creative achievements. None of the other domains of risk taking, as measured by the gambling task and risk taking questionnaire showed a statistically supported correlation with any of the measures of creativity. These results corroborate Sternberg's idea of 'sensible' risk taking in creativity. He proposed that some domains of risk taking are more pertinent to creativity (for instance, the idea of being socially 'different') than others such as health and safety (risk of losing limbs or life) (Sternberg, 1997). Presenting a radical idea to a social group, unveiling a new artwork at

an exhibition, publishing a collection of stories or poems and many other forms of social interactions involve a high degree of risk. All of the aforementioned acts are risky since there is always some uncertainty associated with the social evaluations. These creative acts thus require individuals who are willing to take risks in the social domain.

The second study was based on a much larger sample size and a diverse group of participants. The larger sample size also provided the statistical confidence required for the regression models. The results from this study demonstrated that social risk taking was the only statistically significant predictor of the measures of creativity. This provided support for the initial findings that creative individuals are more likely to take risks exclusively in the social domain.

The lack of correlation between financial risk taking in the gambling domain and measures of creativity is particularly important to discuss, since in most studies of risk taking, performance on gambling tasks is often equated to a general tendency towards risk taking. Results from both the performance on the gambling task and scores from the questionnaires point towards the same direction; risk taking in the financial-gambling domain is not related to creativity. These results provide further evidence for the argument that the association between risk taking and creativity is domain specific.

Relationships between risk taking in the other domains (such as ethical) and creativity have been studied in specific scenarios such as deception (Gino & Ariely, 2012; Mai, Ellis, & Welsh, 2015). For instance, Gino and Ariely (2012) reported that individuals with creative personalities cheated more than others in a deception task. Additionally, priming individuals to think creatively led them to be more likely to exhibit unethical behaviour. I did not find support for these findings in this study. Both studies in the current research indicated that the likelihood of taking ethical risks is not related to measures of creativity. Niepel et al (2015) recently criticized the study by Gino and Ariely, suggesting that due to the artificial nature of the deception tasks, participants were

not only presented with the opportunity to behave dishonestly but they were also tempted to do so. They reported that self and teachers' reports of creativity in a sample of students are positively linked to ethical decision making (as opposed to the negative associations found previously). Additionally, they reported that in the long term, creativity was not a general predictor of ethical decision making. Given the current scientific evidence, it is difficult to draw a strong conclusion based on these mixed findings and the question of the relationship between ethical risk taking and creativity remains unanswered.

I found mixed results with creative achievement scores in this study. While CAQ scores were significantly correlated with social risk taking in study 1, I did not find this in our larger, diverse group of participants in study 2. Additionally, none of the domains of risk taking were significant predictors of CAQ scores in the regression model. Inconsistency in the results may arise from the scoring structure of CAQ. Scores from this questionnaire are known to be highly skewed and several researchers have suggested using a nominal scoring procedure to avoid using raw scores (Silvia et al., 2012). Although, I have adopted this approach in our data analyses to limit the skewness in the scores, there are limitations to these correctional procedures and these are amplified as the datasets get larger. Consequently, it might have resulted in the differences in the two datasets. Future research could shed light on this association by using different measures of creative achievements.

Interestingly, unlike the questionnaire-based measures, the task-based measures of creativity did not correlate with risk taking (nor did they correlate with other measures of creativity). The tasks of creativity, such as the alternate uses task measure divergent thinking, a component of creativity. Divergent thinking has been theorized as an important dimension of creativity, however it doesn't comprise all of it (Baer, 2011). Moreover, divergent thinking tasks aim to measure creativity in a very short time period. From the present results, it seems likely that attitudes of risk taking in the social domain

are related to biographical and personality based measures of creativity (creative personality, ideation or achievements) as opposed to the task based measures.

2.5.1 Limitations And Future Directions

Although the present research has shown that there is a significant association between creative personality and social risk taking, this study did not aim to explore the causal link between them. Previously, Dellas and Gaier (1970) have suggested that it is the personality traits which affect creative behaviour, rather than the reverse. Future studies could explore the possibility of manipulation of social risk taking and investigating its effects on creativity. Additionally, external factors such as societal norms affect how individuals react to their own and others actions involving risk and uncertainty. This could be an important factor manipulating creative output. For instance, in some cultures, questioning authority is often suppressed and all forms of risk taking (calculated or otherwise) are discouraged when compared to the others. Future studies could investigate the extent to which cultural differences affect both risk taking and creativity.

2.6 Conclusion

This study demonstrates that individuals who possess a creative personality and mind-set are more likely to take risks exclusively in the social domain. These results thus highlight the importance of the role social risk taking attitudes play in creativity. The current research also emphasizes the need to investigate risk taking in a domain specific context. In our understanding, this is the first study to show that not only is creativity linked to risk taking, but also that this relationship is highly domain specific.

CHAPTER THREE

THE 'WILDE' SIDE OF CREATIVITY: CREATIVITY & RISK TAKING IN SEXUAL MINORITY

3.1 INTRODUCTION

Oscar Wilde famously wrote in his essay 'The Soul of Man Under Socialism' – "*Selfishness is not living as one wishes to live; it is asking others to live as one wishes to live*" (Wilde, 1891). Ironically, the celebrated playwright and the creative genius of the late 19th century, was imprisoned for 'gross indecency' which was a legal term used to describe homosexuality. Along with Wilde, many creative writers (Sappho, Forster), philosophers (Plato, Socrates), painters and sculptors (Michelangelo and Leonardo da Vinci) have been praised countless number of times in the literature for their rich creative skills (Cooper, 2005). Given that the majority of these creative geniuses lived prior to the 21st century, it is quite hard to assess, with any certainty, their sexual orientation. This is due to both the limited availability of documentation regarding their personal lives and the political climate existent at the time which may have limited the availability of such documentation. However, suggestive information can be gleaned through biographies, masterpieces and personal records. For instance, Cooper (2005) discussed the renaissance artistic movement and the strong undertones of male and female beauty in the nude. He listed many influential painters and sculptors from the renaissance period such as Leonardo da Vinci and Michelangelo Buonarroti (both learned in a wide variety of arts, sciences and invention) who were either involved in the denunciation of homosexuality, had sexual interests in younger 'androgynous' men or dedicated sonnets of their passionate love for male friends. Along the similar lines, Vuksanović et al (2014) presented a list of music composers from the 17th, 18th and 19th century who had same-sex romantic or erotic affairs. With the increasing awareness and acceptance of

homosexuality, a significant number of the celebrated artists (such as Andy Warhol) are openly accepting of their own sexual orientation. Although the link between creativity and homosexuality is tentative, it has resulted in a strong commonly held belief that homosexuality is associated with creative genius. However, a review of the scientific literature on this topic reveals a much-complicated understanding of this relationship.

3.1.1 CREATIVITY IN SEXUAL MINORITY

Before we delve any further, I would like to clarify that in this article the word homosexual is not used as a clinical term (used in the past to identify anyone who is not exclusively heterosexual), but as a term for the identification of lesbian and gay individuals (LG in LGBT). The word homosexual thus does not include other sexual minorities, for instance bisexuals and asexuals.

3.1.1.1 Scientific evidence and literature review

The earliest studies on the exploration of a relationship between sexual orientation and creativity were focused on treating sexual minority as a pathological condition and often placed individuals in unseemly categories. For instance, one of the earliest research on this topic was conducted by Ellis (1959) who compared a group of homosexual '*patients*' in psychotherapy with a group of heterosexual psychotherapy patients. According to the author, in his study while heterosexual patients were '*exceptionally heterosexual*' based on their past sexual experiences, homosexual individuals had 'severe homosexual problems'. Homosexual individuals were classified based on their past experiences as (i) bisexuals (sexual encounters with individuals of the same and opposite sex), (ii) fixed homosexuals (homosexuals who maintained their own 'sexual role') or (iii) inverts (homosexuals who maintained a 'sex role inversion'). Criteria for rating the creativity of each individual were ideational fluency, flexibility, novelty, sensitivity to problems, synthesizing ability and analysing ability. Ellis reported significantly higher creativity ratings for heterosexual individuals when compared to homosexual individuals.

His study was later criticised on a number of serious issues pertaining to the facts that (a) his participant group comprised of patients in therapy, (b) creativity scores were determined by dictionary definitions and (c) that he himself was the experimenter, the rater as well as the therapist (Domino, 1977). In a similar study, no significant differences were found between the creativity of homosexuals and that of heterosexuals (Deluca, 1966) as measured by the Klopfer's scheme for evaluating creative potentials. Although this study used unwarranted subgroups of individuals based on their past sexual roles, it managed to highlight the issue of the common practice of referring to homosexuality as a pathological condition at that time as well as presented contradictory results.

Until 1973, Homosexuality was categorised as a mental disorder in the Diagnostic and Statistical Manual of Mental Disorders published by the American Psychiatric Association (1968). With the sixth printing of DSM-II in 1974, homosexuality was finally removed from this list (American Psychiatric Association, 1973). This saw a positive change in the outlook of researchers working on investigating the psychology of sexual minority. For example, Domino published a study for which participants were recruited from various organisations promoting and defending the rights of homosexuals, social centres for homosexual activities, occupations involving creative endeavours and college counselling centres (Domino, 1977). Each individual's self-reported sexual orientation was accepted at its face value. This study reported results similar to those reported by earlier studies; there were no significant differences in the scores obtained by homosexual individuals on various creativity measures as compared to the heterosexual control group. Creativity was measured using nine measures of various dimensions of creativity (which included the Remote Associates Task, Adjective check List, Barron-Welsh Revised Art Scale, Alternate Uses Task, Consequences Task, Associational Fluency, Franck Drawing Completion Test, Holtzman Inkblot test and Openness to Experience Inquiry). This study provided a clear indication of a lack of evidence in support of the hypotheses that non-

heterosexuals are more creative than heterosexuals. However, Domino himself was wary of the validity of the measures of creativity that were being used at that time. A recent online study also reported no significant differences in the creativity scores of homosexual males as compared to heterosexual males (Noor, Chee, & Ahmad, 2013). Although, this study lacked the general rigor of a systematic investigation of creativity in sexual minority (extremely small sample size, limited validity of the measures of creativity used etc.), it contributed to the evidence pointing towards no difference in the creativity of heterosexuals and non-heterosexuals.

There seems to be a general lack of substantial literature on the investigation of creativity in sexual minority groups. Demb, in her review on gay men in the arts (Demb, 1992) invited researchers to investigate the incidence of gay men in the arts, while outlining the reasons why there seems to be a lack of literature on the topic. She highlighted that stigmatization of both homosexuals and the researchers who study them as well as homophobia interfere with such undertakings. Despite these concerns, a few studies exist which aimed to systematically investigate the relationship using large survey based samples. Lewis & Seaman (2004) used data from the General Social Survey collected in the USA (in 1993 and 1998) from 180 Lesbian, Gay and Bisexual (LGB) individuals and from 1938 heterosexual individuals. The authors found that a significantly higher number of LGB individuals had visited galleries or art museums, attended a classical music or opera performance and gone to dance performances when compared to heterosexuals. In conjunction to consuming arts, LGB individuals were significantly more likely to have played a musical instrument and to have taken part in a live performance than straight respondents. Finally, LGB individuals were more educated, twice as likely to live in cities, less likely to be married, have children and had lower household incomes. These results indicate that LGB individuals are more likely to consume and produce art. There is a clear disconnect between findings from the survey

based studies which report a positive link and findings from the studies exploring the psychology of creativity in LGB individuals which report the absence of a relationship.

A possible explanation for this disconnect could be glanced through a study conducted by Konik & Crawford (2004). The authors examined the relationship between cognitive flexibility (as a measure of creativity) and sexual orientation and hypothesized that bisexuals possess higher levels of cognitive flexibility. This hypothesis was driven by Zinik's 'flexibility model of bisexuality' which proposed that since bisexuals traverse between the heterosexual and homosexual communities, they possess higher cognitive flexibility (Zinik, 1985). Konik and Crawford also referred to Carter (1985) who suggested that "androgynous individuals may demonstrate more cognitive flexibility because their personalities incorporate both traditionally feminine and masculine traits". These speculations motivated them to parcellate sexual orientation in three categories instead of two (Lesbian/gay/homosexual, heterosexual, and bisexual/other). Their findings revealed that individuals with a non-exclusive sexual identity (i.e. bisexual/biaffectionate) scored significantly higher on the Cognitive Flexibility Scale when compared to heterosexuals or homosexuals. These results indicated a need to isolate bisexuality and treat it as a separate group in investigations of sexual orientation. As Charyton pointed out in her review on the relationship between sexual orientation and creativity (Charyton, 2007), it appears that bisexuality may have a higher empirical relationship with creativity. She invited researchers to address the question – "Is there a relationship between bisexuality and creativity?". In order to bridge this gap in the current understanding of the effect of sexual minority on the measures of creativity, the present research aimed to investigate the role of bisexuality and homosexuality in creativity. This was approached using a wide array of measures of creativity and sophisticated assessments of sexual orientation. I hypothesised that bisexuals would score significantly higher than heterosexuals and homosexuals on various measures of creativity. Mosing et

al (Mosing, Verweij, Abé, de Manzano, & Ullén, 2016) provided another possible explanation for a failure to find support for the 'homosexual creativity'. Using an adapted domain specific creative achievement questionnaire (with 7 domains such as the visual arts, creative writing, music etc.), they found that LGB's show high creative engagement only in specific domains (theatre and writing) and not the others. This consequently guided the present research to understand and explore creativity as a multi-domain, multi-dimensional trait.

3.1.2 Risk Taking In Sexual Minority

Besides drawing attention to bisexuality, Charyton's influential review also alluded to the unconventionality and risk taking involved in being a sexual minority and being creative. She wrote – "Gay men are unconventional with supporting the societal norms of typical male behaviour. Unconventionality is a trait of creative personality" and "Traditionally men are taught to act like other men and women are taught to act like other women…Through breaking these boundaries, males and females can become more creative through diminished gender role stereotypes" (Charyton, 2007). These views are similar to those put forward by Torrance who believed that "highly creative individuals are more successful in integrating seemingly opposite personality characteristics such as masculinity-femininity, independence-dependence, and conformity-nonconformity" (E. Paul Torrance, 1995). The role of non-conformity and non-normality in LGB's was also identified by Brown (Brown, 1989) – "by being *normatively different* LGB's develop greater creativity than heterosexuals in generating scripts for their lives…by lacking clear rules about how to be lesbian and gay in the world, we have made up the rules as we go along". Along these lines, a study was conducted with Bisexual, Heterosexual and Lesbian women on self-assessed creativity (Ben-Zeev, Dennehy, & Kaufman, 2012). This study reported that by blurring intergroup boundaries and thus challenging mono-sexuality (e.g. heterosexuality and homosexuality), bisexual women showed higher levels

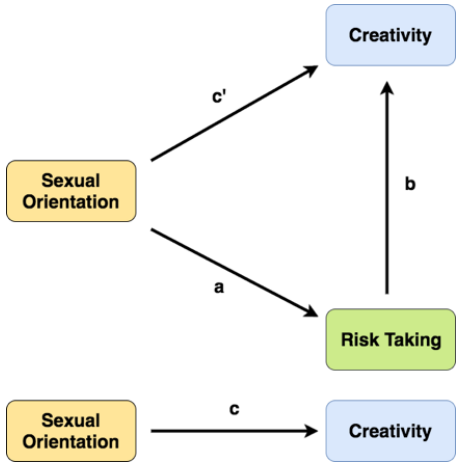
of self-assessed creativity when compared to homosexual and heterosexual women. It thus appears that non-conformity and risk taking are integral variables in the relationship between sexual orientation and creativity.

Sexual orientation not only influences creativity; it also affects risk taking. Ample evidence from the past studies clearly indicates that a significantly higher rate of risk taking exists in the sexual minority groups. A study on the association between health risk behaviours and sexual orientation used a battery of self-reported questionnaires and found that LGB youth were more likely than their peers to report having been victimised and threatened, engaging in suicidal ideation, misusing tobacco, alcohol and illegal drugs and engaging in sexual risk behaviours (Garofalo, Wolf, Kessel, Palfrey, & DuRant, 1998). Similarly, Busseri et al (Busseri, Willoughby, Chalmers, & Bogaert, 2008) found that the individuals who reported bisexual and same-sex attractions were involved in risky behaviours more than heterosexuals and that this effect was mediated by social factors such as peer victimization and relationship with parents. Rice et al (2013) reported that LGBTQ adolescents were more likely to report staying with a stranger and less likely to live in a shelter and were more likely to engage in unprotected risky sex at their last encounter. A majority of the past studies have explored risk taking in LGB adolescents. However, similar results have also been reported for adult populations. A study investigating the association between sexual orientation and tobacco smoking found that bisexual men and women were daily smokers to a higher extent than heterosexuals (Lindström, Axelsson, Modén, & Rosvall, 2014). Similarly, for a range of illegal drug use, bisexuals and homosexuals are more likely to report using them along with misuse of the prescription drugs (Corliss et al., 2010).

It is evident from the past literature that sexual orientation affects both creativity and risk taking. There is also ample evidence of a complex relationship between creativity and risk taking. For instance, a recent study by Tyagi et al (Tyagi, Hanoch, Hall, Runco,

& Denham, 2017) showed that the relationship between creativity and risk taking is highly domain specific. Additionally, these two traits are not only related, they are also causally linked. In an experiment investigating the link between dishonesty (ethical risk taking) and creativity, Gino and Wiltermuth (2014) tested the causal effect of crossing ethical boundaries on creativity. As hypothesised, it was found that individuals who cheated were more creative than non-cheaters and that acting dishonestly led to greater creativity. Given the previous results, it is thus likely that the relationship between sexual orientation and creativity is mediated by risk taking. In the present study, I thus aimed to test the following hypothesised mediation model: sexual orientation affects creativity and this interaction is mediated by risk taking (**Figure 3.1**).

Figure 3.1 – Model illustrating the indirect effect of sexual orientation on creativity through risk taking



Causal links (paths) are indicated by letters a, b, c and c'. The overall model with total effect of sexual orientation on creativity is also depicted.

Finally, previous literature studying the effect of sexual orientation on risk taking has frequently focused on the health-safety domain (such as unsafe sex, illegal substance use, tobacco smoking, alcoholism, suicidal ideation, delinquent activities etc.). Very little is known about how being a sexual minority affects risk taking in the other domains such as social, financial or recreational. The links between sexual orientation and risk taking

in the other domains are relatively unexplored. The present research thus treated risk taking as a domain specific trait and explored the relationship between sexual orientation and domain specific risk taking. I used the domain specific risk taking questionnaire (DOSPERT) to measure five different domains of risk taking.

3.1.3 OBJECTIVES

The main objectives of this research were – (i) To investigate group differences in creativity and risk taking in heterosexual, homosexual, bisexual and asexual/other individuals using multidimensional, multi-domain approaches and (ii) To explore the relationship between sexual orientation, creativity and risk taking through mediation analysis.

3.1.4 ASSESSMENT OF SEXUAL ORIENTATION

In a manner similar to creativity, there is currently no agreed consensus on how sexual orientation should be defined or assessed.

3.1.4.1 Invasive measures:

Research on sexual orientation has relied heavily on direct measures, such as the detection of physiological changes (to sexual or erotic stimuli) to assess sexual attraction. Chivers et al. (Chivers, Rieger, Latty, & Bailey, 2004) assessed genital and subjective arousal in women, men and transsexual individuals. Their study reported that men and transsexuals were specifically aroused to preferred sexual stimuli (for example, homosexual men being aroused to male sexual stimuli) while women were nonspecific in their arousal patterns, experiencing genital and subjective arousal to both male and female sexual stimuli. Similarly, other recent studies have also demonstrated that self-reported bisexuals, both men and women, exhibit stronger physiological and subjective arousal patterns to specifically bisexual stimuli (Cerny & Janssen, 2011; Rosenthal, Sylva, Safron, & Bailey, 2012; Rullo, Strassberg, & Miner, 2015).

3.1.4.2 Non-invasive measures:

Although measures such as phallometric assessments are valued for providing an insightful indication of sexual orientation, they often are invasive in nature and may also be susceptible to deception. Indirect measures of sexual orientation are thought to capture automatic reactions, which may or may not be accessible to conscious introspection and hence are relatively resistant to deception. To this effect, a number of indirect methods have been developed. For instance, a number of studies have used simple viewing time paradigms to show that individuals spend more time looking at images they are sexually attracted to (higher response latencies), as compared to the images they are not (Imhoff et al., 2010; Imhoff, Schmidt, Weiß, Young, & Banse, 2012; Lykins, Meana, & Strauss, 2008). Additionally, more sophisticated indirect measurements such as gaze pattern analyses, pupil dilation, reaction times and implicit association of concepts have also been used. Several studies for instance have looked at how homosexual and heterosexual, men and women directed their visual attention while looking at gender specific images. Reported findings indicated that both men and women initially gaze at the face of the sexually preferred stimuli (Hewig, Trippe, Hecht, Straube, & Miltner, 2008). Hall, Hogue and Guo (2011) later showed that these gaze patterns were more gender specific, in that women gazed longer at the faces compared to men and men gazed longer at the upper body and waist-hip region of their preferred image, compared to women. Furthermore, Lykins et al. (2008) found that women dispersed their attention evenly between the male and female figures whilst men had a strong preference for female figures.

Previous research has also led to the development of several psychometric measures to assess sexual orientation. For example, Fernandez, Quiroga and Rodriguez (2009) developed and validated Sexual Attraction Questionnaire (SAQ) by showing that it was able to differentiate reliably between individuals who are attracted to males,

females, both sexes or neither sex. Another example is Epstein Sexual Orientation Inventory (ESOI) (Epstein, McKinney, Fox, & Garcia, 2012) which showed that there existed a degree of flexibility in the expression of sexual orientation in all people. Chung and Katayama (1996) conducted a meta-analysis of 144 studies on gay, lesbian and bisexual individuals, pointing out the methodological shortcomings of assessing sexual orientation techniques. They reported that past studies have employed following methods for assessing sexual orientation (i) self-identification, (ii) past behaviour/history, (iii) sexual preference, (iv) single dimension continuum ranging from heterosexuality to homosexuality and (v) multiple dimensions. The authors reported that the first four methods are limited and suggested that future studies assessing sexual orientation should focus on a multidimensional approach involving emotional and physical attraction. A survey of the past studies specifically aimed at investigating creativity or risk taking in sexual minorities reveal a limiting factor (**Table 3.1**). Most of these studies have either employed self-identification ("Do you consider yourself to be – *Heterosexual/Homosexual/Bisexual/Other*") or past behaviour ("In the past, have you had sex with – *Exclusively women/exclusively men/mostly women/mostly men/both men and women/I've not had sex*") to assess sexual orientation. To overcome the limitations of the previous studies, in the present research (Study 1), I employed a paired-choice task in conjunction with eye tracking to assess sexual/physical attraction to erotic picture stimuli. In addition, the current study also used the Sexual Attraction Questionnaire to assess emotional attachment, attraction and feelings towards people of the same and opposite sex in real life scenarios (such as "*At parties, I like to be near (in physical contact with) women/men*"). To further enrich this multidimensional approach of the assessment of sexual orientation, I also asked the participants to report their sexual orientation as well as their past sexual behaviour (dimension of time).

Table 3.1 – Past studies on creativity and risk taking in sexual minority

Authors	Year	# LGBs (# bisexuals)	# heterosexuals	Assessment of Sexual orientation	Measure of creativity
Ellis	1959	66	150	Self-Identification	Rating by Therapist
De Luca	1965	42	25	Past Behaviour	Klopfer's scheme for creative potential
Domino	1977	125	125	Self-Identification	Remote Associates Task, Adjective Checklist, Barron-Welsh Revised Art Scale, Alternate Uses, Consequences, Associational Fluency, Franck Drawing Completion Test, Holtzman Inkblot Test, Openness to Experience Inquiry
†Lewis & Seaman	2004	180	1938	Past Behaviour	Frequency of going to art museum, classical music, dance performance; Frequency of making art, playing music or performed live
Konik & Crawford	2004	140 (40 bisexuals)	202	Self-Identification	Cognitive flexibility scale (perception of options and alternatives)
Ben-Zeev et al	2012	254 (132 bisexuals)	2605	Self-Identification	Self-report of creative abilities
Noor et al	2013	38	34	Self-Identification	Khatena-Torrance Creative Perception Inventory, Something About Myself
†Mosing et al	2016	337	4157	Past Behaviour	Creative Achievements Questionnaire

Authors	Year	# LGBs (# bisexuals)	# heterosexuals	Assessment of Sexual orientation	Measure of risk taking
†Garofalo	1998	104 (81 bisexuals)	3998	Self-Identification	Past behaviour (violence, suicidal ideation, illegal drug use, sexual activity,
Busseri et al	2008	168(132 bisexuals)	3594	Self-reported sexual attraction	Past behaviour (alcohol, Marijuana, tobacco, hard drugs consumption, sexual activity, delinquent activity)
†Rice et al	2013	211	1578	Self-Identification	Past behaviour (sexual activity)
†Lindström et al	2014	9572 (5591 bisexuals)	3234	Self-Identification	Past behaviour (tobacco smoking)
†Hatzenbuehler et al	2015	104 (73 bisexuals)	9431	Self-Identification	Past behaviour (illegal drug use)

List of past studies investigating the relationship between a) sexual orientation and creativity, b) sexual orientation and risk taking. †Survey data based studies.

3.2 STUDY 1

This study was conducted with an eye tracking setup in a laboratory setting in the UK.

3.2.1 METHOD

3.2.1.1 Participants:

Seventy-eight volunteers (44 female, M_{age} = 22 years, SD = 4.13) were recruited for this study from a paid participant pool and the study was advertised via university wide posters and focused meetings with the sexual minority groups. All participants were paid £8/hour for their participation. The study received ethical approval from the research ethics committee at the researchers' university.

All the participants were based in the UK and majority of them were Caucasian (87.2%) while others were Black/Black British (3.8%), Mixed/Multiple ethnic groups (7.7%) and Asian/Asian British (1.3%).

3.2.1.2 Assessment of sexual orientation:

Sexual orientation was assessed through attraction by employing Sexual Attraction Questionnaire and a paired choice eye tracking task.

(i) Preference judgment task:

A computer-based preference judgment task was used in conjunction with eye tracking to assess the eye gaze patterns. In this task, participants were presented with a set of picture stimuli comprising of images of male and female models (31 male and 31 female stimuli) in partial clothing (e.g. swimwear). The picture stimuli that were labelled for non-commercial reuse were randomly selected from fashion oriented websites and image databases. All stimuli were controlled for image properties such as dimension, resolution, colour and brightness.

Participants were shown all the stimuli before the commencement of the experiment and were asked to familiarise themselves with the set at their own pace. This was then followed by a rating phase where they rated these randomly presented stimuli on a scale of attractiveness (ranging from -10 to 10). The rating phase was self-paced and on average lasted no longer than 10 minutes. Finally, in the judgment phase, they were presented with pairs of stimuli (one on the left, the other on the right side of the screen). They were instructed to indicate the preferred stimuli by a button press and were asked to be as fast as possible. Each trial lasted for four seconds with an inter-trial interval of two seconds. Participants were asked to move on if they missed a trial and these trials were treated as missing data in the subsequent analysis. All image pairs were randomly presented across all the participants. In each trial, a customised computer program carefully selected each pairing in order to control for the 'distance of preference' of these stimuli. This distance was based on the ratings provided by participants in the rating phase of this task. This ensured that for each participant, a personalised and subjective image pairing was presented. The computer program also controlled for the randomised presentation of all the image pairs with matched distances across all the participants. In total, 200 trials were presented to each participant.

Eye tracking data was collected throughout the judgment phase and this was also handled through a digital trigger sent from the custom computer program. A SMI Red eye tracker with a sampling rate of 60 Hz was used and all the stimuli were presented on an LED monitor with a resolution of 1920 x 1080. One participant had corrected to normal vision but their anti-glare glasses did not interfere with the sensor of the eye tracking device.

(ii) Sexual Attraction Questionnaire (SAQ):

SAQ was developed to measure attraction to men and attraction to women in adults (Fernández et al., 2009). SAQ has been shown to be stable, consistent and reliable

in measuring sexual attraction through a sixteen-item questionnaire. Participants rated their degree of agreement with the sixteen items on a Likert scale from 1 to 7 (1 = Lowest agreement, 7 = Highest agreement). Each item in this questionnaire represented a feeling either in a social situation such as "*When I go out (to bars, discotheques etc.), I feel like flirting with women*" or on its own such as "*I like to think that men notice me*".

3.2.1.3 Measures of creativity:

The measures of creativity that were employed in this study included (i) Divergent thinking task, (ii) Compound remote associates task (cRAT), (iii) Runco's Ideational Behavioural Scale short form (RIBSs), and (iv) Creative Personality Scale (CPS).

3.2.1.4 Measure of risk taking:

Domain Specific Risk Taking Questionnaire (DOSPERT) was used as a measure of risk taking in this study.

3.2.1.5 Self-reports:

In addition to the eye tracking, tasks and questionnaires, sexual orientation, past sexual behaviour, creativity and risk taking were also assessed. Participants were asked to rate themselves on a five-point scale on '*How creative are you*' and '*How risk taking are you*'. For sexual orientation and attraction, they chose one of the available options which described them the best on '*Do you consider yourself to be – 'Heterosexual/ Homosexual/ Bisexual/ Asexual*' and '*In the past I've had sex with – Only women/ Only men/ Both women and men/ I've not had sex*'.

3.2.1.6 Procedure:

Eye tracking and the behavioural (preference judgment) task were presented using a custom visual basic computer program on a Windows operating system. Data from all the questionnaires, questions related to the demographics and self-reports were collected online using an online survey platform with no restriction on time (SurveyMonkey Inc, *www.surveymonkey.com*). Eye tracking task and the questionnaires were spread across

two, one hour sessions per participant. The order of the task and questionnaires was randomised across all the participants.

3.2.1.7 Data Analysis:

Eye tracking data was analysed using SMI BeGaze software. For each participant, missing trials were removed from the analyses and the remaining data was entered in an area of interest (AOI) analysis. Pictures on the left and right of the screen were defined as the two AOIs. Thus, for each picture in every trial, eye tracking measures were calculated. Since Net Dwell Duration (total amount of time spent glancing and fixating within an AOI) was highly correlated with the other measures of eye tracking such as glance count, fixation count, entry time and first fixation duration, it was retained for all the subsequent analysis. Finally, *Net Dwell Duration* across all the 'male' pictures were averaged and those across all the 'female' pictures were averaged. This provided a measure of the total time spent dwelling on male and female stimuli for each participant.

SAQ scores were calculated by independently integrating the ratings on all the items representing attraction to males as well as all those representing females. These sub-scores ('attraction to males' and 'attraction to females') were then dichotomised twice to obtain a fourfold typology – (i) Attracted to males or (ii) Attracted to females or (iii) Attracted to both or (iv) Attracted to neither. Individuals falling under 'Attracted to both' and 'Attracted to neither' were simply classified as Bisexuals and Asexuals respectively. For the other two categories ('Attracted to males' and 'Attracted to females'), sex information was integrated to obtain the Heterosexual and Homosexual groups.

Divergent thinking (AUT) and creative problem solving (cRAT) tasks were analysed using standard measures. cRAT yielded a composite score by summing all the correct solutions. AUT gave two measures of divergent thinking – originality and fluency; originality referred to the statistical infrequency of the ideas and the fluency score was

the total number of ideas generated for each common household item. All the questionnaires were analysed using the standard scoring keys applicable for the respective questionnaires. Each item on the creative personality scale was scored positive or negative (for the reverse items) and a total was used as the creative personality score. A similar creative ideation score for RIBSs was calculated. Finally, DOSPERT provided a score for the likelihood of risk taking in each of the five domains.

For each of the calculated scores, a between group analysis (one way analysis of variance/ANOVA) was performed on the three groups – Heterosexuals, Homosexuals and Bisexuals. For Study 1, asexuals were removed from the analysis as there were only four asexual individuals in this study (the results of ANOVA did not change upon the inclusion or exclusion of these individuals in the study). IBM SPSS (IBM Corp. Released, 2015) and JASP (JASP Team, 2016) statistical software were used to conduct all the statistical analysis.

3.2.2 RESULTS

Percent net dwell duration (time spent glancing and fixating within the areas of interest normalised by the total time of the trial) was highly correlated with all the other measures of eye tracking [glance count (Pearson's coefficient 0.70), fixation count (0.97), first fixation duration (0.80)]. Other measures were also highly inter-correlated. Since % net dwell duration showed highest reliability, we used it to identify the three sexual orientation categories among our participant dataset. % net dwell duration difference between female and male stimuli for each participant yielded a range with a maximum duration of 51.46% for the female stimuli and 39.4% for the male stimuli. A cut-off threshold of 10% was used to categorise the bisexual individuals; this meant that those who had a less than 10% net dwell difference (female to male) were identified as attending to both the male and female stimuli. This method resulted in the three groups – Homosexual, Heterosexual and Bisexual.

There was 66.23% coherence between the groups identified based on the eye tracking and those identified with the sexual attraction questionnaire. Moreover, eye tracking and self-reports of sexual orientation showed a 75.32% coherence. Finally, sexual orientation groups as determined by the self-reports and the sexual attraction questionnaire had the highest coherence of 80.7%. All the three methods of identifying sexual orientation were thus highly reliable.

A statistical comparison of the three groups with a one-way ANOVA did not reveal any significant differences in the self-reports of creativity, creative personality score or creative ideation score among the three groups (Self-reports: $p = 0.6$; CPS: $p = 0.12$; RIBS: $p = 0.24$). Similar results were obtained for the task based measures of creativity such as divergent thinking and remote associates score [Fluency: $p = 0.78$; Originality: $p = 0.58$; cRAT scores: $p = 0.3$].

In a manner similar to that of creativity, the likelihood of risk taking did not show any significant difference between the three sexual orientation groups. No significant differences existed in the social ($p = 0.41$), recreational ($p = 0.13$), ethical ($p = 0.42$), health-safety ($p = 0.76$) or financial domains (gambling: $p = 0.44$; investment: $p = 0.97$).

3.2.3 DISCUSSION

As opposed to some of the recent findings in the past literature, I did not find any significant differences in the creativity between different bisexuals and other sexual orientation groups. These results raised two possibilities. It is possible that the previous studies which reported no differences in the creativity of homosexuals/bisexuals as compared to the heterosexuals were reporting consistent results and the more recent studies reporting differences need robust replication. On the other hand, it also appears highly likely that the results from the present study lack statistical power since they originated from a smaller bisexual group. A closer look at the few studies reporting

significant differences in the creativity reveal that those studies were mostly based on large survey based samples with diverse populations.

Results from study 1 also pointed towards no significant differences in any domain of risk taking among the groups. The results from social, recreational, financial and ethical domains in this study (and study 2) are novel and add to a handful of studies which investigated these types of risks in the sexual minority. Since a plethora of studies exist which have reported a significantly higher health-safety risk taking in homosexual/bisexual youth, results from study 1 (reporting no significant differences) thus require more scrutiny. I further questioned the low number of bisexual participants and lack of diversity in this study. This motivated me to conduct study 2 in a larger, diverse group of participants.

Assessment of sexual orientation using self-reports, sexual attraction questionnaire and measures of eye tracking was highly reliable. However, past sexual behaviour did not make a clear contribution to our understanding of the sexual orientation. For instance, people who reported that they never had sex in the past could not be categorised while some self-reported heterosexuals also reported having sex with both men and women in the past. Due to a high incidence of such cases in this dataset, past sexual behaviour was not included in further analysis.

Table 3.2 – Descriptive statistics – Study 1 and 2

Study 1	**Homosexuals (n=13)** ***Mean (SD)***	**Bisexuals (n = 24)** ***Mean (SD)***	**Heterosexuals (n = 41)** ***Mean (SD)***	**Asexuals (n = 4)** ***Mean (SD)***
Age	21.3 (2.75)	21.04 (4.2)	22.87 (4.34)	-
CPS	6.61 (4.11)	6.66 (3.56)	8.48 (3.92)	-
RIBS	2.95 (0.73)	2.93 (0.78)	3.21 (0.64)	-
Social Risk	5.32 (0.94)	5.33 (0.83)	5.56 (0.7)	-
Recreational Risk	3.64 (1.66)	3.5 (1.64)	4.25 (1.41)	-
Financial (Gambling)	1.46 (1.11)	1.51 (0.93)	1.85 (1.39)	-
Financial (Investment)	2.61 (1.12)	2.69 (1.19)	2.71 (1.34)	-
Health-Safety Risk	3.2 (1.04)	3.47 (1.16)	3.43 (1.07)	-
Ethical Risk	2.56 (1.11)	2.95 (1.17)	3.02 (1.03)	-

Study 2	**Homosexuals (n = 28)** ***Mean (SD)***	**Bisexuals (n = 34)** ***Mean (SD)***	**Heterosexuals (n = 307)** ***Mean (SD)***	**Asexuals (n = 37)** ***Mean (SD)***
Age	30.14 (6.91)	29.02 (7.29)	36.01 (11.53)	36.62 (13.85)
CPS	5.75 (3.85)	7.5 (2.91)	7.43 (4.13)	5.08 (3.59)
RIBS	1.68 (0.57)	2.16 (0.7)	1.66 (0.6)	1.51 (0.75)
Social Risk	4.92 (0.98)	5.06 (0.95)	4.99 (1.22)	4.26 (1.45)
Recreational Risk	3.52 (1.28)	3.38 (1.52)	3.04 (1.36)	2.48 (1.18)
Financial (Gambling)	2.73 (1.58)	2.69 (1.78)	1.89 (1.34)	2.03 (1.27)
Financial (Investment)	3.42 (1.45)	3.28 (1.36)	3.45 (1.5)	2.96 (1.45)
Health-Safety Risk	3.6 (1.17)	3.19 (1.22)	3.05 (1.19)	2.61 (1.12)
Ethical Risk	3.21 (1.2)	2.86 (1.24)	2.2 (1.1)	2.24 (1.16)

Mean and standard deviations for age, creative personality, creative ideation and the five domains of risk taking in study 1 and study 2.

3.3 STUDY 2

One of the primary reasons for a dearth of studies lacking statistical rigor in sexual minority is the nature of the distribution of sexual orientation. By definition, homosexuals, bisexuals, asexuals etc. are minorities. Thus, given a population, random sampling of individuals leads to a relatively small number of LGB participants in most studies. In addition to this, factors attributing to social pressure such as homophobia, fear of coming out, confusion and condemnation by a majority of the society further reduces the number of individuals willing to be identified in a laboratory based study. These social factors vary from culture to culture and from nation to nation, further giving rise to a large imbalance in the number and quality of studies on sexual minorities. Unfortunately, study 1 in the present article was also limited by the small number of individuals identified as bisexuals, homosexuals and asexuals. Consequently, I conducted study 2 on an online platform which allowed data collection from a large and diverse sample. This anonymous mode of data collection also removed the need to have an experimenter-participant interaction which increased the chances of collecting data from sexual minority groups.

3.3.1 METHOD

406 volunteers (197 female, M_{age} = 35.07 years, SD = 11.43) participated in this study on an online data collection platform called Amazon Mechanical Turk (Buhrmester et al., 2011). All the volunteers participated in exchange for a monetary reward. All the participants were based in the USA and the majority of them were White (78.32%) while others were African American/Black (9.36%), Asian/South East Asian/West Asian/South Asian (6.4%), Latin American (4.93%), Mixed (0.74%) and Aboriginal (0.25%).

Due to the online nature of the data collection method, behavioural tasks and eye tracking measures could not be included in this study. Since net dwell duration from the

eye tracking, SAQ and self-reported sexual orientation had a high degree of agreement, I assessed sexual orientation through scores on SAQ and self-reports in this study. CPS and RIBS were used to measure creative personality and ideation while DOSPERT provided the likelihood of risk taking in each of the five risk domains. In addition to the questionnaires, self-reports of sexual orientation, creativity and risk taking were also assessed. All the questionnaires and self-report items were presented using the online survey platform SurveyMonkey with no restriction on time. Standardised scoring keys were used for all the questionnaires. Similar to Study 1, a one-way ANOVA was performed using IBM SPSS data analysis software. This was followed by Post-hoc Tukey test for pairwise comparisons across the sexual orientation groups. In case of a failure to demonstrate homogeneity of variance, non-parametric statistical methods were employed. These involved performing a Kruskal-Wallis test followed by Dunn's pairwise comparisons. Finally, a plugin of SPSS software called PROCESS was used to conduct the mediation analysis.

3.3.1.1 Mediation analysis:

Mediation analysis is a statistical analysis technique which is most frequently employed in the social sciences to investigate the 'mediating' effect of an intervening variable on a theorised causal relationship. The intervening (mediating) variable essentially affects the causal relationship between two variables in such a way that the effect of the independent variable on the dependent variable is either diminished or is completely lost. The former is referred as a partial mediation effect while the latter is termed as a complete mediation effect. Consider the following scenario; an independent variable X is theorised to cause a dependent variable Y. In addition, it is also hypothesised that a third variable M might intervene the causal effect of X on Y in such a way that either the effect of X on Y is completely lost or that it is diminished. In this case, the variable M acts as a mediator with a mediating effect on the relationship between

variables X and Y. In the present study (**Figure 3.1**), sexual orientation is modelled as the variable X, creativity is modelled as the variable Y and risk taking acts as a mediator M.

Mediation analysis (and statistical path analysis in general of which mediation analysis is a type), is a theory driven statistical analysis technique which is used to explore the causal links in a correlational structure. Due to the nature of this analysis, it assumes that the temporal order (the causal chain) of the three variables is known from theory, previous knowledge or common sense. In the present study, there is a clear temporal order in which sexual orientation, risk taking and creativity are arranged. Sexual orientation is a highly stable trait and is highly unlikely to change with experimental conditions. It is also highly stable over the course of time. Creativity on the other hand is dynamic and has been shown to be affected by a variety of factors. It is thus highly likely that in a relationship between sexual orientation and creativity, sexual orientation is the cause, as opposed to creativity. Furthermore, previous experiments have demonstrated that an experimental change in an individual's risk taking behaviour, changes their creative output. Thus, in the present study, the mediation model presented in figure 3.1 was explored.

As previously mentioned, mediation analysis is a type of path analysis. In a mathematical sense, this analysis relies on multiple instances of 'multiple regression' equations (*paths*) in order to infer the causal links between the cause, effect and the mediator. The basic approach to examining for empirical evidence of a mediation effect was provided by Baron and Kenny (1986). In essence, four different paths (regression equations) are computed in each instance of a mediation analysis. These paths are detailed as follows:

(i) A path from the cause X to the effect Y independent of a mediator, also known as a *total effect*. By convention, this path is denoted as c (**Figure 3.1**).

(ii) A path from the cause X to the mediator M, usually denoted by the letter a.

(iii) A path from the mediator M to the effect Y, usually denoted by the letter b.

(iv) And finally, a path from the cause X to the effect Y in the presence of the mediator M, also known as a *direct effect*. This is usually denoted by c'.

The amount of mediation in a mediation analysis is known as the *indirect effect*.

Total effect (c) = direct effect (c') + indirect effect (ab)

In a contemporary mediation analysis, the variable of interest is thus the extent and the statistical significance of the indirect effect, since it quantifies the change in the causal effect of X on Y upon the introduction of a mediator (c-c').

3.3.1.2 Tests for assessing the amount of the mediation effect:

Over the years, a multitude of techniques have been proposed to test the effectiveness of a mediator in a mediation analysis. However, currently two tests/ methods are most commonly employed to assess the indirect effect: Sobel test and the bootstrapping technique. Although, it is a common practice to report results from the Sobel test, bootstrapping has been shown to be more comprehensive. The present research utilised both of these tests to diminish the rate of false positives in the current findings. Both of these methods work well only in large data samples, hence the data from study 1 was not suitable for this analysis. These methods are briefly discussed as follows:

(i) Sobel test:

This test was first proposed by Sobel (1982) and it requires the calculation of the standard error of path a and the standard error of path b. These standard errors (S_a and S_b) are calculated by running t-tests on the regression coefficients a and b respectively. The Sobel test then uses S_a, S_b, a and b to test whether the indirect effect of the cause variable (sexual orientation) on the effect variable (creativity) via the mediator (risk taking) is significantly different from zero. This test provides an estimate of the statistical significance of the difference (p value) and a standard Z score.

(ii) Bootstrap method:

Bootstrapping is a non-parametric technique and is based on the idea of resampling with replacement. This resampling procedure is then iterated over several iterations (usually 5000 or 10000 for robust results). For each of these sample, an indirect effect is calculated. Thus over 10000 iterations, a sampling distribution can be constructed. Finally, this distribution can be tested to calculate a confidence interval (or a p value). If the confidence interval does not include zero, it is inferred that the indirect effect is significantly different from zero or in other words, a mediation effect exists.

I followed recent recommendations (Wen & Fan, 2015) and report traditional mediation effect size measure (ratio of indirect effect to the total effect) instead of the Preacher and Kelly's Kappa squared. The statistical significance of all the indirect effects were tested using both the bootstrapping procedure (bias corrected, 10000 bootstrap samples) and the Sobel test. In order to implement the mediation analysis, sexual orientation groups were reduced from a multi-categorical variable (four groups) to a dichotomous variable (two groups, LGB vs heterosexual).

3.3.2 RESULTS

All the questionnaires showed high reliability (Cronbach Alpha for CPS: 0.79, RIBS: 0.88, SAQ score for attraction to males: 0.96, SAQ score for females: 0.95). Consistent with the results from study 1, there was a high degree of coherence in the groups identified by SAQ and those identified by the self-reports of sexual orientation (81.28%).

There was a statistically significant difference in the self-reports of creativity among various sexual orientation groups as determined by one-way ANOVA [$F(3,402) = 4.02$, $p = 0.008$, $\eta^2 = 0.029$]. Post hoc Tukey test revealed that bisexuals reported significantly higher creativity as compared to heterosexuals ($p = 0.004$) and asexuals (p

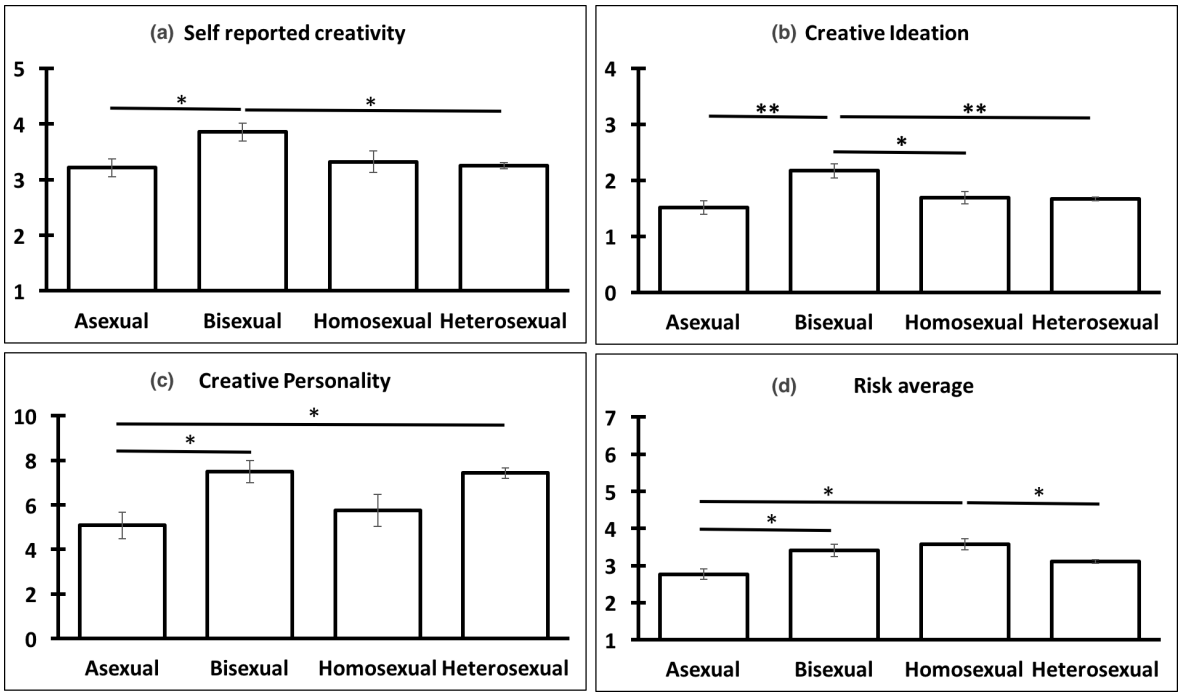
= 0.028). All the other comparisons were not statistically significant (**Figure 3.2a**). Similarly, a statistically significant difference was revealed between the creative ideation scores among the four sexual orientation groups as determined by one-way ANOVA [$F(3,402) = 7.789$, $p < 0.001$, $\eta^2 = 0.055$]. Post hoc comparisons showed that bisexuals scored highest in creative ideation [compared to heterosexuals ($p < 0.001$), asexuals ($p < 0.001$) and homosexuals ($p = 0.013$)]. No other groups were significantly different from each other (**Figure 3.2b**). Finally, creative personality scores showed statistically significant differences between the sexual orientation groups [$\chi^2(3) = 17.462$, $p < 0.001$]. The results of Dunn's post hoc tests showed that bisexuals scored significantly higher than asexuals ($p_{adj} = 0.03$); heterosexuals also scored significantly higher than asexuals ($p_{adj} = 0.002$) while all the other comparisons showed no statistical significance (**Figure 3.2c**).

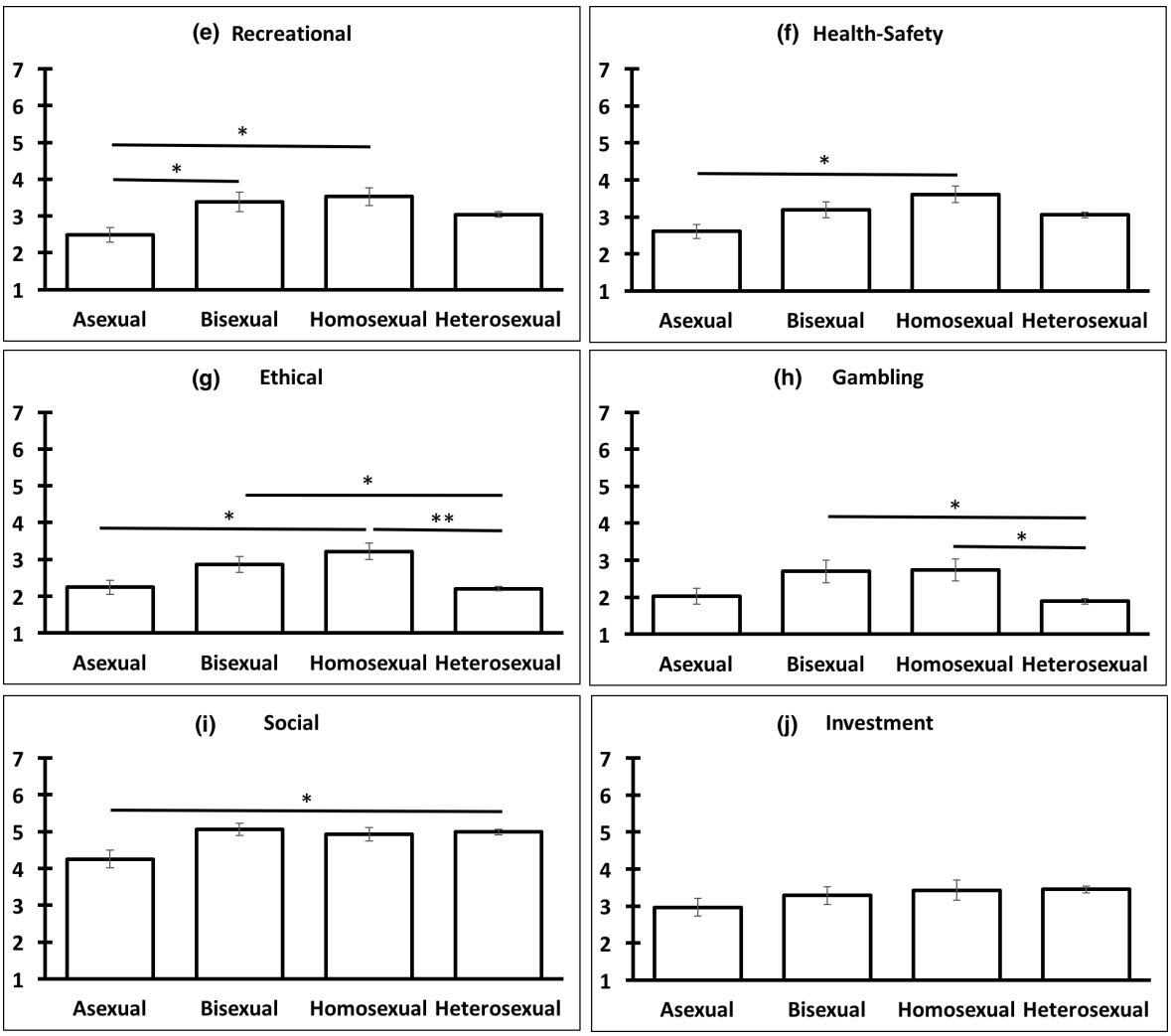
The average likelihood of risk taking in all the risk domains revealed a significant difference between groups [$F(3,402) = 6.027$, $p = 0.001$, $\eta^2 = 0.043$]. Bisexuals were significantly more likely to take risks as compared to asexuals ($p = 0.009$) while homosexuals were more likely to take risks when compared to asexuals and heterosexuals ($p = 0.001$ and 0.031 respectively) (**Figure 3.2d**). For recreational risk taking, there was a significant difference between sexual orientation groups as revealed by ANOVA [$F(3,402) = 3.995$, $p = 0.008$, $\eta^2 = 0.029$]. Bisexuals and homosexuals were more likely to take recreational risks as compared to asexuals ($p = 0.026$ and 0.012 respectively) (**Figure 3.2e**). (Note: For recreational risks and the other domains which follow in the results section, all the pairwise comparisons that did not yield a statistically significant difference are not reported in the text for brevity).

Similarly, for health-safety risk taking, the ANOVA revealed a statistically significant difference between the groups [$F(3,402) = 3.885$, $p = 0.009$, $\eta^2 = 0.028$]. In a post hoc test, homosexuals were found to be more likely to take health-safety risks as

compared to asexuals (p = 0.004) (**Figure 3.2f**). The likelihood of ethical risk taking was also significantly different across the groups [F(3,402) = 9.674, p < 0.001, η^2 = 0.067]. Tukey post hoc test revealed that both homosexual and bisexual groups were more likely to take ethical risks as compared to heterosexuals (p < 0.001 and p = 0.006 respectively). Additionally, homosexuals were also more likely to take ethical risks in comparison to asexuals (p = 0.003) (**Figure 3.2g**). A similar pattern was observed in the domain of gambling. Kruskal-Wallis H test revealed a significant difference between groups [χ2(3) = 15.442, p = 0.001]. Post hoc Dunn's test indicated that both homosexuals and bisexuals are more likely to gamble as compared to heterosexuals (p_{adj} = 0.013 and 0.037 respectively) (**Figure 3.2h**). Kruskal-Wallis H test for the likelihood of Social risk taking showed that there was a significant difference across the groups [χ2(3) = 10.269, p = 0.016]. This difference existed between the heterosexuals and asexuals (p = 0.01) as revealed by Dunn's post hoc tests (**Figure 3.2i**). Finally, no significant differences were found in the likelihood of taking investment risks between the sexual orientation groups (p = 0.292) (**Figure 3.2j**).

Figure 3.2 – Effect of sexual orientation on creativity and risk taking in various domains





*Findings from One-way ANOVA on the measures of creativity and those of domain specific risk taking among the four sexual orientation groups (*p < 0.05, **p < 0.001).*

The regression analysis for the mediation model revealed that risk taking significantly mediated the effect of sexual orientation on creativity. There was a direct effect of sexual orientation on creative ideation (b = -0.14, t(367) = -3.3, p = 0.001). More importantly, results indicated that sexual orientation was a significant predictor of risk taking (b = -0.19, t(367) = -3.18, p = 0.001), and that risk was a significant predictor of creative ideation (b = 0.21, t(366) = 5.92, p < 0.001). Although, sexual orientation was still a significant predictor of creativity after controlling for the mediator (b = -0.1, t(366) = -2.43, p = 0.015), Sobel test showed that the difference between the direct and an indirect effect was significant (Z = -2.77, p = 0.005) with an effect size of 0.285,

consistent with partial mediation. Bootstrap estimation approach yielded a similar result (CI = [-0.08, -0.01]).

3.3.3 DISCUSSION

Most of the incoherence (8.8%) between individuals identified by SAQ and those by self-reports of sexual orientation originated from the individuals identified as asexuals through SAQ. For instance, among all 37 asexuals in this study, only one self-reported themselves as asexual. Among the other asexuals, one individual self-reported as bisexual, three as homosexual while 32 reported themselves as heterosexuals. Due to the higher inconsistencies in the nature of asexuality, I separated this group from LGBs and did not draw inferences on this group.

Unlike study 1, this study provided consistent results when compared to previous findings. Significant difference existed between various sexual orientation groups on the biographical measures of creativity and that of risk taking. LGB individuals scored higher on creative ideation and reported higher creativity self-ratings when compared to heterosexual individuals. However, bisexuals scored higher on creative personality when compared to asexuals with no significant differences with heterosexual individuals. These results suggest that LGBs (specifically bisexuals) not only demonstrate significantly higher cognitive flexibility (as reported by Konik and Crawford, 2004), they also show higher tendencies to generate creative ideas and are more likely to have a creative personality.

Similarly, unlike study 1, in the present study LGBs were more likely to take ethical and financial risks when compared to heterosexuals. Additionally, although differences existed between LGBs and asexuals, no significant differences were found between LGBs and heterosexuals in the health-safety, recreational or social domains. These findings are novel in the social, recreational, ethical and financial domains and further point to the need to treat risk taking as a domain specific trait. Findings in the

health-safety domain however are contradictory to the previous literature. It is worth noting that previous literature on sexual minority has been mostly focused on adolescents (Busseri et al., 2008; Garofalo et al., 1998; Rice et al., 2013) and the studies on health-safety risk taking in the adults are limited (Corliss et al., 2010; Lindström et al., 2014). Additionally, these studies have mostly used items related to illegal drug or tobacco consumption while other items in the health-safety domain (such as unsafe driving) are relatively unexplored. The present findings thus warrant further exploration of specific domains of risk taking in sexual minority.

3.4 General Discussion

Homosexuality is theorised to be associated with creativity, however contradictory evidence exists which prove and disprove this hypothesis. One possible source of the contradictory findings in the previous literature could be the unreliable assessment of sexual orientation and a lack of parcellation of homosexual and bisexual groups. The present research aimed to use reliable biographical measures of creativity to investigate the differences that might exist among sexual orientation groups. Similar to creativity, risk taking in sexual minority has received limited attention, with a majority of studies focusing on health-safety based risks while other domains remain relatively unexplored. In two studies, I investigated the differences in the likelihood of domain specific risk taking among various sexual orientation groups and explored the mediating role of risk taking on the relationship between sexual orientation and creativity. The current methodology aimed to improve upon the existing measures of assessing sexual orientation by implementing a holistic approach which involved assessment of sexual attraction (through eye tracking and sexual attraction questionnaire) and self-reports of sexual orientation and past behaviour.

Findings from a larger, diverse group of participants revealed that significant differences exist in the biographical measures of creativity among the LGB and

heterosexual groups. These novel findings provide additional support to the previous findings from large survey based studies which reported differences in cognitive flexibility among these groups. Furthermore, the direction of these differences is consistent with the notion that LGB individuals (more specifically bisexuals) score higher on measures of creativity as compared to heterosexual individuals. The present study is one of the first to report the effect of sexual orientation on the biographical measures of creativity. In line with the more recent literature, these results contradict the earliest findings (for instance Ellis, 1959) which failed to find these differences due to the limitations in either the reliability of the measures used and/or the assessment of sexual orientation. They also clearly demonstrate the necessity of treating bisexuals as a group independent of the homosexual group.

A significant difference between the more recent studies and studies from the past is the treatment of sexual orientation groups. Charyton (2007) emphasised that it is important to treat the bisexual group as an independent group. Konik and Crawford (2004) demonstrated the effect of separating the bisexual group by reporting significantly higher scores on the cognitive flexibility scale in bisexual individuals. The current research followed this approach and treated the bisexual individuals as a separate group. Consequently, the findings provided strong support to the notion that bisexual individuals demonstrate different patterns of behaviour than both heterosexual and homosexual groups. The present research investigated differences in creativity and risk taking among bisexuals, homosexuals and heterosexuals; future studies on other behavioural traits will benefit from this parcellation scheme of sexual orientation.

A sexual orientation group which presents challenges in its assessment is the asexuals. The studies reported in this article found high level of inconsistencies between the self-reports and other assessments of sexual orientation specifically in the asexual group. Consequently, there is a high need for developing highly sensitive methods of

assessing sexual orientation in the future studies. Sexual attraction as a method of assessing the sexual orientation is more nuanced than sexual arousal. It is also less invasive than phallometric studies. However, a more holistic approach incorporating sexual arousal, sexual attraction, self-reports and past behaviour should prove more effective at reliably classifying individuals into various sexual orientation groups. As evident from the current research, investigations in the future will benefit from implementing such approaches.

Previous literature on risk taking in sexual minority has been focused on the risks in the health-safety domain. This is the first study to report the differences in the ethical and financial domains of risk taking among the sexual orientation groups. As hypothesised, the sexual minority groups (LGBs) were more likely to take these risks than the heterosexual groups. However, no such differences were found in the social, recreational or health-safety domains, thus highlighting the importance of investigating domain specific nature of risk taking. The present research also found a partial mediating role of risk taking on the relationship between sexual orientation and creativity. This was also consistent with the theorised model since sexual orientation has been shown to affect risk taking which in turn has been known to affect creativity. I suspect that these findings capture the effect of marginalisation of the sexual minority in the society which consequently leads to an increased likelihood of risk taking in the specific domains and an openness to experience, factors which are known to affect creativity.

3.5 CONCLUSION

This study aimed to investigate the effect of sexual orientation on creativity and domain specific risk taking and the role risk taking might play in the relationship between sexual orientation and creativity. This study is one of the first to report that sexual minority score high on creative ideation and creative personality, and are more likely to

take risks in specific domains of risk taking. It also demonstrates for the first time that risk taking is a partial mediator of the effect of sexual orientation on creativity.

CHAPTER FOUR

THE 'RIGHT' SIDE OF CREATIVITY: PREJUDICE, CREATIVITY AND RISK TAKING

4.1 INTRODUCTION

Albert Einstein once said – "It is more difficult to disintegrate a prejudice than an atom" (Ummerkutty, 2005, p. 137). Racial prejudice and strong ideological beliefs arguably were at the base of some of the major socio-political events, recently across the world (such as the European Union referendum in the United Kingdom and the presidential election in the United States of America). This is not surprising since predictors of prejudice are also known to predict anti-immigrant attitudes (Duckitt & Sibley, 2010b), attitudes towards socially threatening or competitive groups (e.g., unemployment beneficiaries; (Duckitt, 2006)) as well as attitudes on socio-cultural political issues (Crawford & Pilanski, 2014; Van Hiel & Mervielde, 2002a).

Based on the pioneering work by Adorno, Frenkel-Brunswik, Levinson, & Sanford, 1950, for a long time it was believed that socio-political ideologies are an expression of an authoritarian personality and is unidimensionally organized along a left-right dimension with extremes in "antidemocratic, pro-fascist, prejudiced and conservative attitude as compared to egalitarian, tolerant, liberal or social attitude" (Duckitt & Sibley, 2010a). Adorno defined the authoritarian personality as a type of personality (now recognised as attitude) which involves a "potentially fascistic individual" and which is characterized by a belief in absolute obedience or submission to authority as well as a belief in simple answers (or a black and white worldview). Duckitt refined Adorno's theory and proposed a dual process motivational (DPM) model of ideological beliefs or social attitudes (Duckitt, 2001). According to this model, there are at least two relatively independent (orthogonal) dimensions of socio-political attitude –

right-wing authoritarianism (RWA) and social dominance orientation (SDO). Duckitt and Sibley also noted that RWA and SDO are not personality traits but dimensions of social attitude and belief. This proposal was based on the observation that the items on the scales of RWA and SDO consist solely of statements of social belief and attitude rather than behavioural reactions or tendencies. Thus, DPM model had two main implications. Firstly, socio-political attitudes and beliefs are not unidimensional. Secondly, these two dimensions are not as deeply rooted in personality as previously believed. For instance, an item on the RWA scale, "*What our country really needs, instead of more "civil rights" is a good, stiff dose of law and order*" clearly relates to a social attitude as compared to behavioural tendency, an example of which can be seen in an item from the Big-five personality scale ("*I see myself as someone who is reserved*"). Thus, "although individuals' scores on the RWA and SDO scales have shown high levels of stability over time and situations…they could be changed by priming or situational manipulations, or change in individuals' group position or socio-political situation" (Duckitt & Sibley, 2010a).

4.1.1 RIGHT-WING AUTHORITARIANISM, SOCIAL DOMINANCE ORIENTATION AND CREATIVITY

Right wing authoritarianism has been defined as a socio-political attitude which features a high level of conventionalism, a high level of submission to the established and legitimate authorities and a high level of aggression in the name of these authorities (Altemeyer, 2006). RWA has been related to social conservatism or traditionalism as compared to liberalism, personal freedom, openness and autonomy. Social or cultural conservatism is referred to the "preservation of ancient moral traditions of humanity" and is based on the assumption that "political problems are religious and moral problems" (Kirk, 1953, p. 8). Previous studies have also shown that RWA is positively correlated with racial prejudice (Duckitt & Farre, 1994), rigidity and intolerance of ambiguity

(Adorno et al., 1950). In comparison, Social dominance orientation is defined as "an individual tendency to view groups in hierarchical terms" and a belief that some groups are inherently superior than the other groups (Islam, 2014). SDO has been related to economic conservatism and has been labelled as a belief in hierarchy, power and inequality as compared to concern, equality, humanitarianism, social welfare and egalitarianism. Economic conservatism refers to the attitude which deals with the involvement of the government and the regulation of private enterprise in the economic lives of its citizens (Everett, 2013). SDO has been found to be positively correlated with racial prejudice, nationalism, cultural elitism, sexism, political-economic conservatism, meritocracy, military policy, punitive policies and support for war and military action in Iran and Syria (Ho et al., 2015; Pratto, Sidanius, Stallworth, & Malle, 1994). SDO has also been shown to be negatively associated with *noblesse oblige* and policies (such as social welfare, civil rights and environmental policies) that reduce inequality between nationals and foreigners, men and women, rich and middle class, heterosexuals and homosexuals.

Given the positive relationship between socio-political attitudes and traits like rigidity and intolerance of ambiguity, it is likely that socio-political attitudes are related to creativity. Related findings from the previous research have been scarce but consistent. A meta-analysis of the association between right-wing ideological attitudes and cognitive complexity revealed that there was a preference for simplicity on the right-wing side of the spectrum (Van Hiel, Onraet, & De Pauw, 2010). In a similar study, liking David Duke (a former leader of the Ku Klux Klan and Nazi sympathizer) was positively associated with liking simplicity in polygons which in turn has been shown to be associated with low creativity (Eisenman, 1992). Eisenman further elaborated that "creative people tend to look at issues in a more complex way and should be somewhat immune to simplistic

or authoritarian-like appeals". His views on the preference of complexity in creative individuals have also been echoed by Barron and Runco.

A negative correlation between measures of authoritarianism and those of creativity has been confirmed in multiple studies. For instance, Bayard-de-volo and Fiebert (1977) showed that in a small sample of pre-school children, divergent thinking scores (as measures of creativity) were negatively correlated with parental authoritarianism as measured by the F scale (a scale for the measurement of RWA; F stands for fascist). A similar relationship has been reported between the F scale scores and scores on the Personal Opinion Survey as a measure of creativity (Eisenman, Grossman, & Goldstein, 1980). Averill (1999) used a 4-item scale of authoritarianism and reported negative correlations with emotional creativity, a concept in which emotions are treated as creative products. However, all of the aforementioned studies have employed either indirect measures of authoritarianism and creativity or the measures whose reliability have been questioned. For instance, F scale as a measure of authoritarianism was criticised for its low reliability and relatively inconclusive findings, which consequently led Altemeyer to develop his Right-wing authoritarianism (RWA) scale (Altemeyer, 2006, pp. 10–14). RWA scale has subsequently been shown to be highly reliable. Using the RWA scale and divergent thinking tests (an established dimension of creativity), Rubinstein (2003) showed the existence of strong negative correlations between authoritarianism and divergent thinking. Despite a consistent set of findings on the relationship between divergent thinking as a measure of creativity and authoritarianism, it remains unknown whether this relationship extends to other dimensions of creativity such as creative personality or creative ideation. Similarly, little is known about the relationship between social dominance orientation and various dimensions of creativity. This is surprising since creativity has been shown to require an intra- as well as inter-disciplinary view and openness to new experiences; traits that are

relatively low in individuals who score high on social dominance orientation (Feist, 1998). The present study thus aimed to delineate the nature of the relationship between biographical measures of creativity (creative personality and ideation) and measures of socio-political attitude (right-wing authoritarianism and social dominance orientation). Drawing from the previous findings and theory, I hypothesized that –

Hypothesis 1: ***The creative personality scores and ideation scores are negatively correlated with scores on RWA and SDO.***

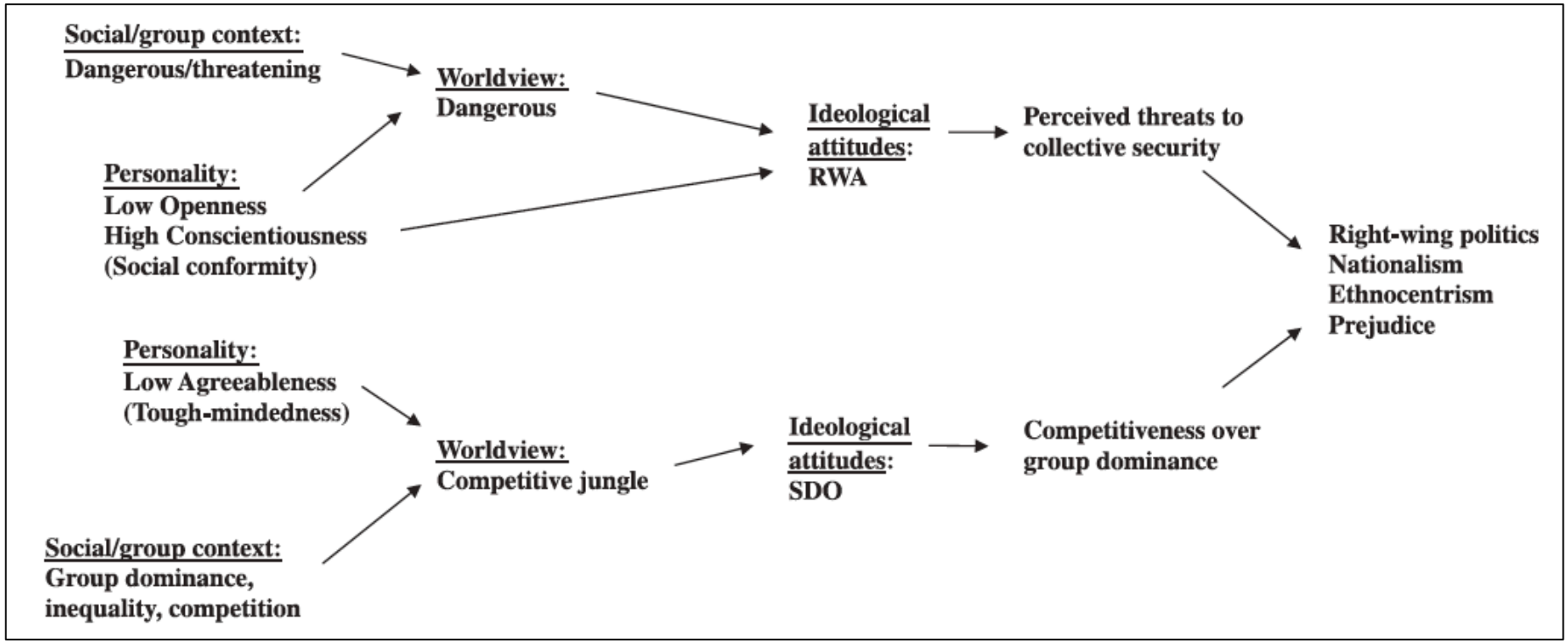
The present research is one of the first studies to systematically investigate the link between biographical (divergent thinking independent) measures of creativity and socio-political attitudes.

4.1.2 DUAL PROCESS MOTIVATION MODEL AND SOCIAL RISK TAKING

In order to explain the origin of the socio-political attitudes, the DPM framework speculates that "the motivational goals or values expressed in RWA and SDO are made chronically salient for individuals by their social worldview beliefs, which are, in turn, products of their personalities and of their socialization in and exposure to particular social environments" (Duckitt & Sibley, 2010a). It is further theorized that childhood socialization practices may produce stable interpretations of, or beliefs about, social reality (social worldviews) which might underlie the two dimensions of the socio-political attitudes. For instance, punitive, strict, harsh socialization (as compared to permissive, tolerant, indulgent socialization) in childhood could lead to the view of the world as a *dangerous, threatening and unpredictable* place (as opposed to a stable, safe and secure place) (Duckitt, 2001). This worldview might then lead to authoritarian ideological beliefs. A second socialization practice dimension is characterized by unaffectionate (as opposed to affectionate) socialization practices. This is understood as "the degree to which socialization practices lack or involve affection, generosity, and valuing others and emphasize honesty and trust towards others". This could lead to a social worldview that

the world is a *competitive jungle*, "characterized by a ruthless and amoral Darwinian struggle for survival…. for resources and power in which might is right, and winning everything seems likely to unleash the motivational goal of seeking power, superiority and dominance over others". This is the second dimension manifested as the social dominance orientation in the DPM framework.

Figure 4.1 – DPM framework of socio-political attitude



[From: (Duckitt & Sibley, 2010a)]

Social risk taking is guided by a perception of risk in situations which involve questioning authority and a perception of threat to one's social status. Given the origin of socio-political attitudes from the social worldviews of dangerousness and competitiveness, and their manifestation in the form of conformity to authority and a need to compete, it is likely that social risk taking might be strongly related to both RWA and SDO. Further support for this hypothesized association can be found in the 'syndrome theory' of authoritarianism. According to this theory, "individuals who score high on right-wing authoritarianism developed an early childhood hostility for authority figures (parents) that could not be expressed under any circumstances" (Rubinstein, 2003). Consequently, as a psychological defence mechanism, reaction formation replaces this hatred by love and by a strong conformity to authority. Thus, "the aggression that is originally developed towards the parents is displaced onto weak groups, such as ethnic minorities or people who deviate from norms (e.g. homosexuals)". Based on this, it could thus be theorized that a suppression of the tendency to question authority (in other words tendency to take social risks) might be associated with conformity and RWA.

Consequently, in the present study, I formulated and tested the following hypothesis –

Hypothesis 2: The likelihood of social risk taking is negatively associated with scores on RWA and SDO. Furthermore, this link is stronger with social risk taking as compared to the other domains of risk taking.

To the best of our knowledge, this is the first study to investigate the relationship between domain specific risk taking and the socio-political attitudes.

4.1.3 Socio-Political Attitudes And The Effect Of Social Risk Taking On Creativity

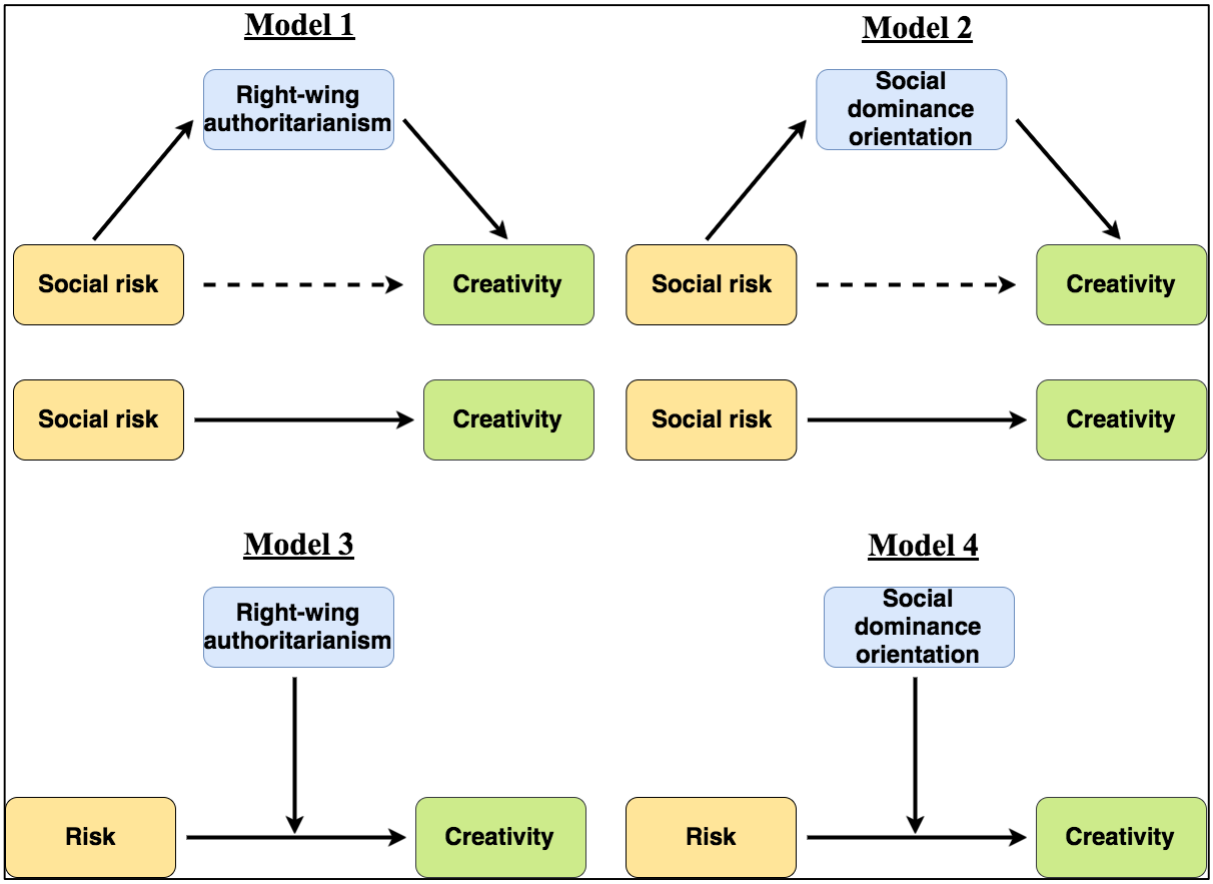
It is intuitive to expect that social risk taking would show a strong relationship with creativity since most creative endeavours require an individual who is willing to risk

their status when creating and presenting their products for evaluation. Tyagi et al., 2017 have previously established that risk taking has a domain specific relationship with creativity. Specifically, the likelihood of social risk taking is a strong predictor of creativity. A tendency to take social risks thus plays an important role in creativity. If hypothesis 2 were true, it could be argued that rigid socio-political attitudes would limit the effect of social risk taking on factors which are affected by it (such as creativity). For instance, RWA might limit social risk taking through a combined suppression of questioning authority and an increased perception of social threat, while SDO might limit social risk taking through a need to compete and consequently an aversion to risking one's social status. Consequently, socio-political attitudes might act as mediators in the relationship between social risk taking and creativity. This hypothesis gains further credence from the fact that previous studies have reported that socio-political attitude itself show strong associations with various dimensions of creativity as well as social risk taking. Based on Duckitt's path analysis, it is highly likely that behavioural tendencies or reactions (such as the likelihood of social risk taking) influence how the world is perceived which in turn could be guiding creativity. Hence, in the present study, I aimed to test the following hypothesis –

Hypothesis 3: Socio-political attitudes mediate the effect of social risk taking on creativity.

In order to test this hypothesis, models 1 and 2 were tested (**Figure 4.2**).

Figure 4.2 – Modelling the role of socio-political attitude in creativity



Theoretical models tested for the effects of socio-political attitude on the relationship between (a) social risk and creativity (Model 1 and 2) and (b) average risk across all domains and creativity (Model 3 and 4).

The current research treated creativity and risk taking as multidimensional traits and aimed to explore their associations with socio-political attitudes.

4.1.4 Objectives

The main objectives of this research were – (i) To explore the relationship between creativity and socio-political attitudes as well as between domain specific risk taking and socio-political attitudes and (ii) To explore the mediating role of socio-political attitudes on the relationship between creativity and risk taking.

4.2 METHOD

4.2.1 PARTICIPANTS

406 individuals (197 female, M_{age} = 35.07 years, SD = 11.43) anonymously participated in this study on an online data collection platform called Amazon Mechanical Turk (Buhrmester et al., 2011). All the volunteers participated in exchange for a monetary reward. All the participants were based in the USA and the majority of them were White (78.32%) while others were African American/Black (9.36%), Asian/South East Asian/West Asian/South Asian (6.4%), Latin American (4.93%), Mixed (0.74%) and Aboriginal (0.25%). The data for this study were collected during the week immediately following the US presidential elections in 2016.

4.2.2 MEASURES OF SOCIO-POLITICAL ATTITUDES

(i) Right-wing authoritarianism scale (RWA):

Right-wing authoritarianism scale is a questionnaire originally developed by Altemeyer (2006, pp. 10–14). It consists of items asking individuals to report their level of agreement on items relating to their authoritarian attitude on a Likert type scale ranging from 1 (strongly disagree) to 7 (strongly agree). Sample items from this scale include "Our country will be destroyed someday if we do not smash the perversions eating away at our moral and traditional beliefs" and "Everyone should have their own lifestyle, religious beliefs, and sexual preferences, even if it makes them different from everyone else". RWA scale has been shown to be a reliable measure of authoritarianism. The present research employed a 12-item short version of this scale.

(ii) Social dominance orientation (SDO_7) scale:

Based on the earlier SDO scale (Pratto et al., 1994), SDO_7 scale is a 16-item questionnaire aimed at measuring the social dominance orientation in two sub-

dimensions: SDO-Dominance (SDO-D) and SDO-antiegalitarianism (SDO-AE) (Ho et al., 2015). Sample items from this scale include "Some groups of people must be kept in their place" and "No one group should dominate in society". Individuals are instructed to report how much they oppose or favour each idea on a scale ranging from 1 (strongly oppose) to 7 (strongly favour).

4.2.3 MEASURES OF CONSERVATISM

A self-reported measure of political conservatism-liberalism was included in the present study. Participants were asked to report how liberal or conservative they are on a Likert scale ranging from 1 (extremely liberal) to 9 (extremely conservative). The items that were included in this measure were (i) *General Conservatism/GC:* "In general, how liberal or conservative do you tend to be?", (ii) *Economic conservatism/EC:* "In general, how liberal or conservative do you tend to be when it comes to economic policy?" and (iii) *Social conservatism/SC:* "In general, how liberal or conservative do you tend to be when it comes to social policy?".

4.2.4 POLITICAL AFFILIATION

The participants were also presented with a list of major political parties (in the USA) and were asked to choose the party that they support or were most likely to support. The political parties that were included in this study were Democratic party, Republican party, Libertarian party and Green party. It is worth noting that throughout this article, I refer to the participant groups who were affiliated to one of the political parties by the name of the political party. Hence individuals who were affiliated to the Democratic party are referred as *Democrats*, those who were affiliated to the Green party as *Greens*, those who were affiliated to the Libertarian party as *Libertarians* and finally those who were affiliated to the Republican party are referred as *Republicans*.

4.2.5 MEASURES OF CREATIVITY

The measures of creativity that were employed in this study included the Creative Personality Scale (CPS) and Runco's Ideational Behavioural Scale – Short Form (RIBSs).

4.2.6 MEASURE OF RISK TAKING

Domain Specific Risk Taking Questionnaire (DOSPERT) was used as a measure of risk taking in this study.

4.2.7 PROCEDURE

Data from all the questionnaires, questions related to the demographics and self-reports were collected online using an online survey platform with no restriction on time (SurveyMonkey Inc, *www.surveymonkey.com*). The study was designed on the online survey platform and the average amount of time spent by the participants was 30 minutes.

4.2.8 DATA ANALYSIS

All the questionnaires were analysed using the standard scoring keys applicable for the respective questionnaires. Each item on the creative personality scale was scored positive or negative (for the reverse items) and a total was used as the creative personality score. A similar creative ideation score for RIBSs was calculated. Finally, DOSPERT provided a score for the likelihood of risk taking in each of the five domains and an overall score for the likelihood of risk taking in all domains. Standard scoring procedures were also employed for the socio-political attitude scales. RWA and SDO scores were obtained by averaging the pro-trait and reverse scoring the con-trait items. SDO scores were further subdivided into two dimensions – SDO-D and SDO-AE. The ratings on conservatism scale were used directly as scores since higher ratings implied higher conservatism in each of the three domains – GC, EC and SC.

For each of the calculated scores, a Bayesian multiple pairwise correlation analysis was performed where each factor was pairwise correlated with all the other

factors. I chose to perform Bayesian correlation analysis on our data since it allowed us to analyse the probability of both null (Bayes Factor BF_{01}) and alternate hypothesis (Bayes Factor BF_{10}) testing. I used a stringent threshold of Bayes factors higher than 30 for determining the statistical significance of the correlations. In order to interpret these results, I followed Jeffreys' suggestions (Jarosz & Wiley, 2014; Jeffreys, 1961), which provide an easy to interpret table of Bayes factors. In short, Bayes factor (BF_{XY}) from 10-30 suggests a strong evidence for X; BF_{XY} from 30-100 suggests a very strong evidence for X and BF_{XY} greater than 100 is decisive for X. A between group analysis (one way analysis of variance/ANOVA) was also performed for each of the calculated scores among the four political parties – Democratic, Republican, Libertarian and Green. This was followed by Post-hoc Tukey test for pairwise comparisons across the political parties. In case of a failure to demonstrate homogeneity of variance, non-parametric statistical methods were employed. These involved performing a Kruskal-Wallis test followed by Dunn's pairwise comparisons. For the continuous measures, simple linear regression analyses informed the degree of prediction. Finally, hypothesized models were tested using the mediation and moderation analysis.

IBM SPSS (IBM Corp. Released, 2015), JASP (JASP Team, 2016) and R with R-studio (R Core Team, 2016; RStudio Team, 2016) statistical software were used to conduct all the statistical analysis. Finally, a plugin of SPSS software called PROCESS was used to conduct the mediation analysis.

4.2.8.1 Mediation analysis:

The present research utilised both the Sobel test and bootstrapping procedure to diminish the rate of false positives in the current findings. I followed recent recommendations (Wen & Fan, 2015) and report traditional mediation effect size measure (ratio of indirect effect to the total effect) instead of the Preacher and Kelly's Kappa

squared. The statistical significance of all the indirect effects were tested using the bootstrapping procedure (bias corrected, 10000 bootstrap samples) and the Sobel test.

4.2.8.2 Moderation analysis:

Moderation analysis is a type of statistical path analysis (like the mediation analysis) which allows one to investigate the intervening role of a variable on a cause-effect relationship between two variables. A prime difference between the mediation and moderation analysis is that as opposed to a mediating variable, the moderating variable does not directly participate in the cause-effect chain of causation, it instead modifies the relationship. This modification or the moderation effect, as it is more formally called, can be either an enhancing or a dampening effect. For instance, if an independent variable X is known to have a causal effect on a dependent variable Y, then it is plausible that another independent variable M could act as a moderator in this relationship if it either enhances the effect of X on Y or dampens it. In the present study, risk taking is modelled as the variable X, creativity is modelled as the variable Y and measures of socio-political attitude act as the moderator M (**Figure 4.2;** Models 3 and 4).

Due to the independence between overall risk taking and measures of socio-political attitude (cross-correlation findings presented in **Table 4.1b**), although RWA and SDO could not mediate the relationship between risk taking and creativity, they could still act as moderators. Therefore, models 3 and 4 were tested for a moderation effect of socio-political attitude on the causal effect of risk taking on creativity. In essence, a moderation analysis is a test of interaction between two independent variables using a multiple regression equation. If the two independent variables (X and M, risk taking and socio-political attitude) demonstrate a significant interaction effect while predicting the dependent variable (Y, creativity), then it is inferred that the moderator significantly alters the causal effect of X on Y. In contemporary moderation analysis, the variables of interest are the statistical significance of the interaction term and its associated effect size

(measured through r squared), however it is customary to report the prediction value (significance and r squared) of each of the independent variable (X and M) as well. This provides a comprehensive test of the overall moderation effect.

4.2.8.3 Test for assessing the boundary of the moderation effect:

Moderation analysis is appropriate when the moderating variable is a categorical variable (i.e. when the moderating variable can be divided into 'levels' or 'categories'). Researchers are often interested in investigating whether the moderation effect occurs in all, some or none of the levels of the moderating variable. In the presence of a moderation effect, it is easier to draw inference since the different levels of the moderating variable allow an easy interpretation of the moderation effect. For instance, a categorical moderator M with three levels (low, medium and high) might enhance the causal effect of X on Y at low levels but might not have any effect at high levels. However, in most frequently encountered scenarios, moderating variables are continuous as opposed to categorical. This is indeed the case with the present study since scores on RWA and SDO questionnaires are measured on a continuous scale. To resolve the issue of a complex interpretation of the moderation effect in case of a continuous moderator, past researchers have used a variety of statistical techniques. A common approach is to 'split' the data into low and high levels based on a median split. Another commonly employed strategy is to test the regression with a continuous variable and plot the interaction using a tripartite division (one standard deviation above the mean, mean, and one standard deviation below the mean). While these techniques are popular, they have disadvantages. For instance, splitting the moderator using the median split or the standard deviation split is dependent on the distribution of the moderator. These splits thus might or might not capture the precise boundaries (region of significance) of the moderator variable where moderation actually happens (if it happens). In order to overcome these issues, the PROCESS plugin (employed in this study) uses a statistically informed procedure called Johnson-Neyman

technique. Proposed by Johnson and Neyman, this technique relies on finding the exact value of the moderator beyond which the moderation effect attains statistical significance (Johnson & Fay, 1950). Once this region of significance has been found, the Johnson-Neyman technique provides small steps of the value of moderator above and below the region of significance. This allows the moderator to be divided into moderating, just-moderating and non-moderating levels. Finally, these levels allow a precise interpretation of the moderation effect.

4.3 RESULTS

Scales for the measurement of creativity and socio-political attitudes showed high reliability (Cronbach's alpha for $SDO_7 = 0.95$, RWA = 0.941, CPS = 0.792 and RIBSs = 0.887).

4.3.1 RELATIONSHIPS AMONG MEASURES OF CREATIVITY, RISK TAKING AND SOCIO-POLITICAL ATTITUDE

Pairwise multiple correlation analysis revealed several statistically supported relationships among variables. Scores on CPS showed statistically supported correlations with the likelihood of risk taking only in the social domain ($BF_{10} > 100$). Score on RIBSs were correlated with the likelihood of risk taking in all the domains however multiple linear regression analyses revealed that only social risk taking was the significant predictor of both CPS and RIBSs scores **(Table 4.1a)**.

The measures of socio-political attitudes (RWA and SDO) and Conservatism (GC, EC and SC) showed statistically supported correlations with creative personality score. All of these measures were negatively correlated with CPS (RWA: Pearson's r = -0.24, $BF_{10} > 100$; SDO-D: Pearson's r = -0.21, $BF_{10} > 100$; SDO-AE: Pearson's r = -0.18, $BF_{10} = 43.66$; GC: Pearson's r = -0.23, $BF_{10} > 100$; EC: Pearson's r = -0.18, $BF_{10} = 65.85$; and; SC: Pearson's r = -0.24, $BF_{10} > 100$). Contrary to this, creative ideation scores did

not reveal any statistically supported correlations either with measures of socio-political attitudes or with those of conservatism ($BF_{10} < 1.27$). The average likelihood of risk taking showed statistically supported correlation only with SDO-D (Pearson's r = -0.18, $BF_{10} = 52.66$); other measures of socio-political attitude and conservatism were not correlated with average risk taking ($BF_{10} < 3.71$). (**Table 4.1b**)

Interestingly, social risk taking showed statistically supported negative correlations with the measures of social dominance orientation and authoritarianism (RWA: Pearson's r = -0.28, $BF_{10} > 100$; SDO-D: Pearson's r = -0.27, $BF_{10} > 100$; SDO-AE: Pearson's r = -0.21, $BF_{10} > 100$) and also with social conservatism (SC: Pearson's r = -0.2, $BF_{10} > 100$). It did not show supported correlations with general conservatism or economic conservatism ($BF_{10} < 21.37$). Recreational risk taking was not correlated with any of the measures of socio-political attitude or conservatism ($BF_{10} < 0.6$). Financial, ethical and health-safety risk taking showed positive relationships only with SDO-D (Financial: r = 0.22, $BF_{10} > 100$; Ethical: r = 0.31, $BF_{10} > 100$ and Health-safety: r = 0.2, $BF_{10} > 100$) and with SDO-AE (Financial: r = 0.18, $BF_{10} = 60.38$ and Ethical: r = 0.25, $BF_{10} > 100$). These three domains were not correlated with either RWA or any of the three measures of conservatism ($BF_{10} < 1.46$) (**Table 4.1b**). Finally, all the measures of socio-political attitude and conservatism showed high internal consistency with statistically supported correlations among RWA, SDO-D, SDO-AE, GC, EC and SC (minimum r = 0.41 between SDO-D and EC, maximum r = 0.87 between GC and EC, all $BF_{10} > 100$).

Table 4.1 – Pairwise correlations among measures of:

a) creativity and domain specific risk taking.

Creativity Measures	Likelihood of taking risks				
	Social	**Recreational**	**Financial**	**Health & Safety**	**Ethical**
CPS	***.38***	***.15***	***.06***	***.02***	***−.06***
	1.211 e +14	6.04	0.15	0.06	0.12
RIBS	***.32***	***.29***	***.22***	***.19***	***.17***
	1.214 e +8	5.022 e +6	983.24	167.08	28.83

b) creativity, domain specific risk taking, socio-political attitude and conservatism.

	RWA	**Social dominance**		**Conservatism**		
		SDO-D	**SDO-AE**	**GC**	**EC**	**SC**
CPS	***−.24***	***−.21***	***−.18****	***−.23***	***−.18****	***−.24***
	16494.1	468.83	43.66	5243.81	65.85	8877.13
RIBS	***−.02***	***−.05***	***−.07***	***−.1***	***−.05***	***−.12***
	0.06	0.11	0.15	0.57	0.11	1.27
Average Risk	***.01***	***.18****	***.14***	***−.03***	***−.02***	***−.01***
	0.06	52.66	3.72	0.07	0.07	0.06
Social risk	***−.29***	***−.27***	***−.21***	***−.17***	***−.08***	***−.2***
	1.087 e +6	188144.37	484.5	21.37	0.21	297.82
Recreational risk	***−.02***	***.12***	***.06***	***−.04***	***−.02***	***−.02***
	0.06	0.6	0.15	0.08	0.06	0.07
Financial risk	***.12***	***.22***	***.18****	***.03***	***.02***	***.06***
	1.46	1862.74	60.38	0.08	0.07	0.15
Health and Safety risk	***.04***	***.2***	***.16***	***.02***	***.02***	***.01***
	0.08	283.66	11.25	0.06	0.07	0.06
Ethical risk	***.07***	***.31***	***.25***	***−.007***	***−.06***	***.03***
	0.18	6.59 e +7	17468.36	0.06	0.12	0.08

Correlation matrices with Pearson's correlation coefficients (in bold, italics) and their respective Bayes factors underneath them. Statistically supported correlations are marked (BF_{10} > 30, **BF_{10} > 100). CPS = Creative Personality Scale, RIBS = Runco Ideational Behavioural Scale, RWA = Right-wing authoritarianism, SDO-D = Social dominance orientation – Dominance, SDO-AE = Social dominance orientation – anti-egalitarianism, GC = general conservatism, EC = economic conservatism and SC = social conservatism.*

4.3.2 EFFECT OF POLITICAL AFFILIATION

(i) On creativity:

One way analysis of variance on the creative personality scores revealed a significant difference among the four political parties [$F(3,402) = 5.57$, $p < 0.001$, $\eta^2 = 0.04$]. Post hoc Tukey test revealed that the Republicans scored significantly lower on creativity personality as compared to the Democrats ($p < 0.001$). All the other comparisons were not statistically significant (**Figure 4.3a**). Similarly, Kruskal-Wallis H test on creative ideation scores also revealed a significant difference among the political parties [$\chi^2(3) = 12.365$, $p = 0.006$]. Post hoc Dunn's test indicated that similar patterns exist for the creative ideation scores with the Republicans scoring lowest; the Greens and Libertarians scored significantly higher on creative ideation when compared to the Republicans ($p_{adj} = 0.041$ and 0.011 respectively) (**Figure 4.3b**).

(ii) On risk taking:

One-way ANOVA conducted on the overall likelihood of risk taking did not reveal any significant differences among the participants who were affiliated to various political parties. Furthermore, none of the domains of risk taking, with the exception of social risk taking, showed any significant differences among people who were affiliated to various political parties. One-way ANOVA on the likelihood of social risk taking showed a significant difference among the political parties [$F(3,402) = 2.96$, $p = 0.032$, $\eta^2 = 0.021$]. Post-hoc tests revealed that the Republicans were significantly less likely to take social risks when compared to the Greens ($p = 0.046$) (**Figure 4.3c**). None of the other comparisons were statistically significant.

(iii) On socio-political attitudes and conservatism:

ANOVA for the RWA scores among the political parties was statistically significant [$F(3,402) = 44.33$, $p < 0.001$, $\eta^2 = 0.248$]. Tukey test showed that the Republicans scored significantly higher on the right-wing authoritarianism scale as

compared to the Democrats ($p < 0.001$), Greens ($p < 0.001$) and the Libertarians ($p < 0.001$). Furthermore, the Libertarians also scored significantly higher on the RWA scores as compared to the Democrats ($p = 0.002$). Other comparisons were not statistically significant (**Figure 4.3d**).

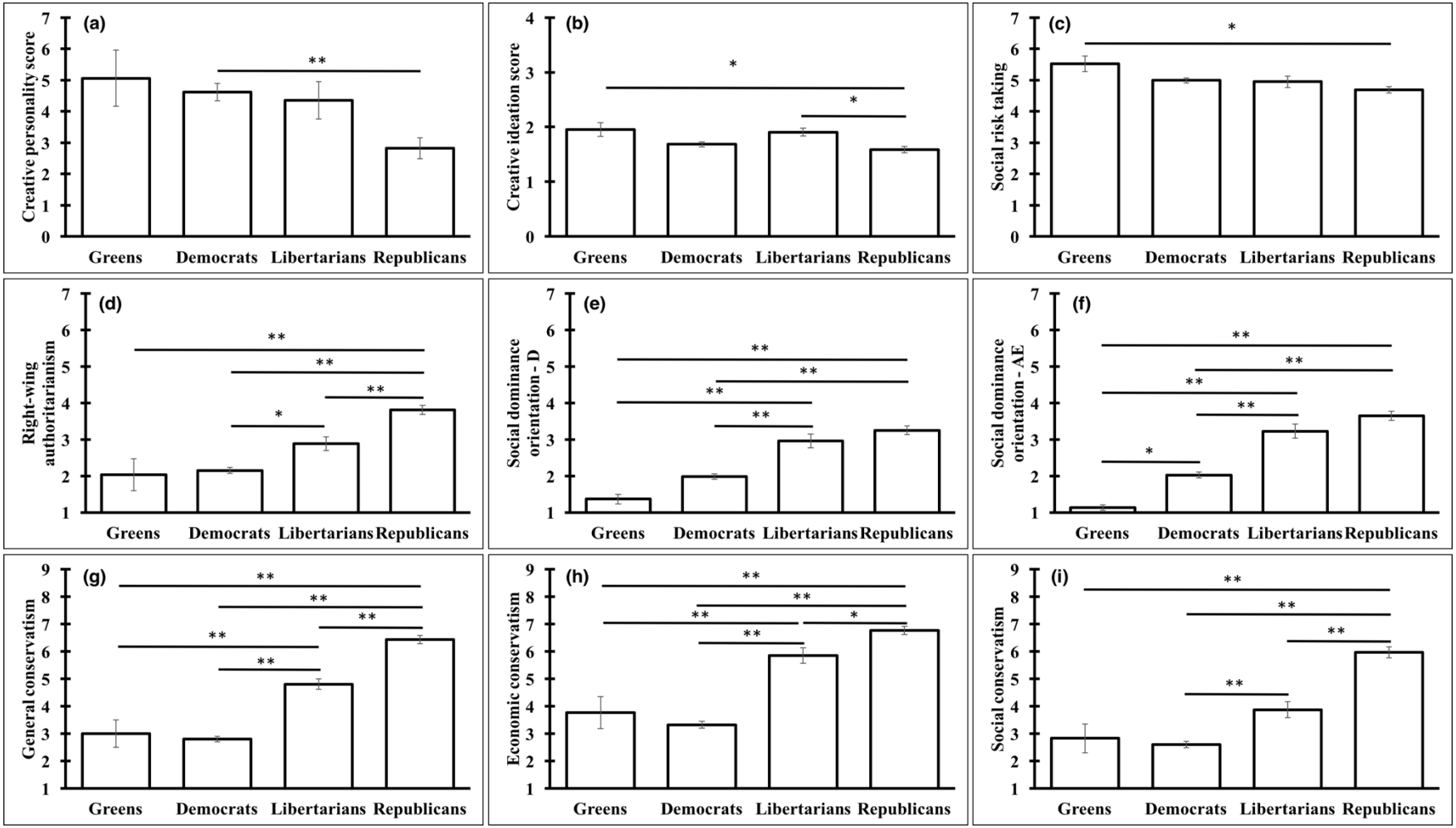
Kruskal-Wallis H test on the SDO-D scores was also statistically significant [$\chi^2(3) = 87.13$, $p < 0.001$]. SDO-D scores of the Republicans and Libertarians were significantly higher than the scores of the Greens ($p_{adj} < 0.001$ for both) and the Democrats ($p_{adj} < 0.001$ for both). There were no significant differences between the Republicans and the Libertarians and those between the Greens and the Democrats on the SDO-D scores (**Figure 4.3e**).

These differences were also reflected in the SDO-AE scores. Kruskal-Wallis H test for the SDO-AE scores revealed statistically significant differences among the four political parties [$\chi^2(3) = 125.95$, $p < 0.001$]. SDO-AE scores of the Republicans and the Libertarians were significantly higher than the scores of the Greens ($p_{adj} < 0.001$ for both) and the Democrats ($p_{adj} < 0.001$ for both). Greens scored significantly lower than the Democrats ($p_{adj} = 0.007$) and there was no significant difference between the Republicans and the Libertarians (**Figure 4.3f**).

The measures of conservatism also demonstrated statistically significant differences among the political parties. ANOVA on the general conservatism scores was statistically significant [$F(3,402) = 143.1$, $p < 0.001$, $\eta^2 = 0.516$]. Post-hoc tests showed that people who were affiliated to the Republican party were significantly more conservative than all the other parties ($p < 0.001$ for all). Additionally, the Libertarians were significantly more conservative than the Greens and the Democrats ($p < 0.001$ for both). There was no significant difference between the Greens and the Democrats (**Figure 4.3g**). Similarly, ANOVA for economic conservatism revealed significant differences [$F(3,402) = 98.4$, $p < 0.001$, $\eta^2 = 0.423$]. The Republicans were significantly more

economically conservative than all the other parties ($p < 0.001$ for Greens and Democrats, $p = 0.023$ for Libertarians). Also, the Libertarians were significantly more conservative than the Greens and the Democrats ($p < 0.001$ for both). The Greens and the Democrats did not differ in economic conservatism (**Figure 4.3h**). Finally, ANOVA for the social conservatism also demonstrated significant differences [$F(3,402) = 79.35$, $p < 0.001$, $\eta^2 = 0.372$]. The Republicans were significantly higher on social conservatism as compared to the Greens, Democrats or Libertarians ($p < 0.001$ for all). Additionally, the Libertarians were socially more conservative than the Democrats ($p < 0.001$). Other comparisons were not significantly different (**Figure 4.3i**).

Figure 4.3 – Effect of political affiliation on creativity, risk taking, socio-political attitude and conservatism



*One-way ANOVA on the measures of creativity, social risk taking, socio-political attitude and conservatism (*p < 0.05, **p < 0.001).*

4.3.3 MEDIATION EFFECTS OF SOCIO-POLITICAL ATTITUDE

Mediation analyses were conducted on the hypothesized models 1 and 2 (**Figure 4.2**). Only the models with creative personality were considered for analysis due to a clear lack of a relationship between creative ideation and measures of socio-political attitude as well as those of conservatism. The regression analysis for model 1 revealed that RWA significantly mediates the effect of social risk taking on creative personality. There was a direct effect of social risk taking on creative personality ($b = 1.26$, $t(404) = 8.33$, $p < 0.001$). More importantly, results indicated that social risk taking was a significant predictor of RWA ($b = -0.34$, $t(404) = -5.91$, $p < 0.001$), and that RWA was a significant predictor of creative personality ($b = -0.41$, $t(403) = -3.15$, $p = 0.001$). Although, social risk taking was still a significant predictor of creativity after controlling for the mediator ($b = 1.12$, $t(403) = 7.19$, $p < 0.001$), Sobel test showed that the difference between the direct and the indirect effect was significant ($Z = 2.75$, $p = 0.006$) with an effect size of 0.11, consistent with partial mediation. Bootstrap estimation approach yielded a similar result (CI = [0.05, 0.26]).

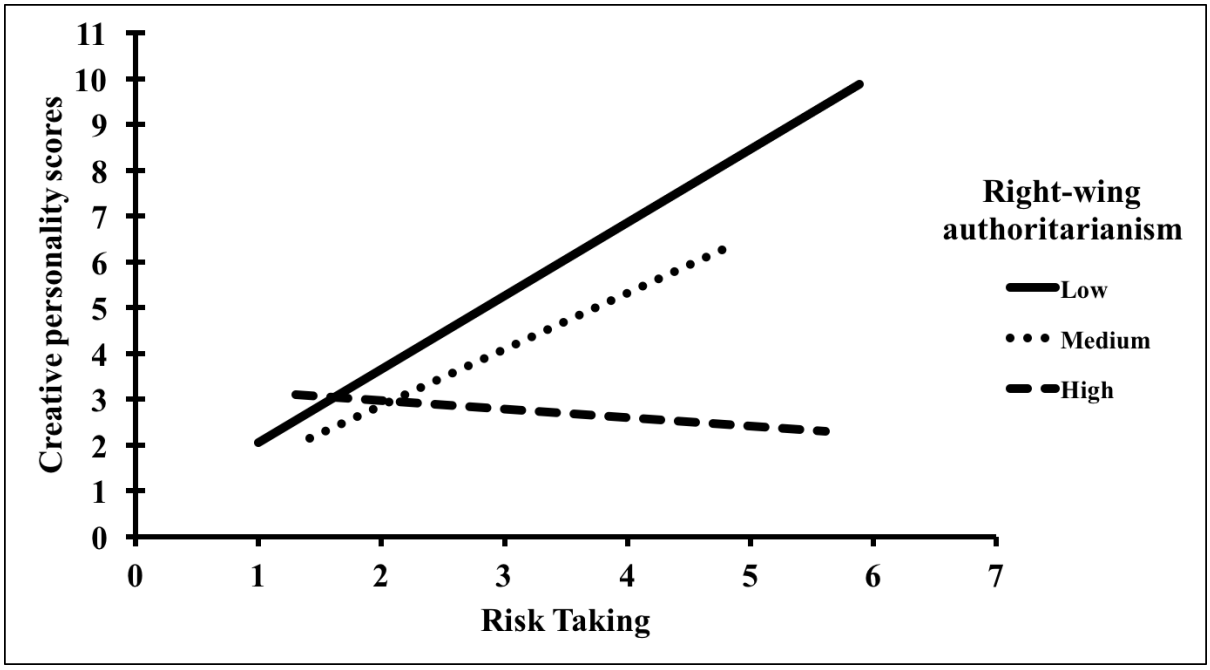
Similar to Model 1, the regression analyses for model 2 revealed that SDO-D and SDO-AE mediated the effect of social risk taking on creative personality. There was a direct effect of social risk taking on creativity ($b = 1.26$, $t(404) = 8.33$, $p < 0.001$). Furthermore, social risk taking was a significant predictor of SDO-D ($b = -0.29$, $t(404) = -5.58$, $p < 0.001$), and that SDO-D was a significant predictor of creativity ($b = -0.34$, $t(403) = -2.41$, $p = 0.016$). Although, social risk taking was still a significant predictor of creativity after controlling for the mediator ($b = 1.16$, $t(403) = 7.43$, $p < 0.001$), Sobel test showed that the difference between the direct and the indirect effect was significant ($Z = 2.18$, $p = 0.029$) with an effect size of 0.08, consistent with partial mediation. Bootstrap estimation approach yielded a similar result (CI = [0.02, 0.22]). Social risk taking was also a significant predictor of SDO-AE ($b = -0.25$, $t(404) = -4.29$, $p < 0.001$), and SDO-

AE was a significant predictor of creativity (b = -0.28, t(403) = -2.22, p = 0.027). Although, social risk taking was still a significant predictor of creativity after controlling for the mediator (b = 1.19, t(403) = 7.73, p < 0.001), Sobel test showed that the difference between the direct and the indirect effect was closer to the significance threshold (Z = 1.93, p = 0.053) with an effect size of 0.06, consistent with partial mediation. Bootstrap estimation approach confirmed that the difference was statistically significant (CI = [0.01, 0.16]).

Although the RWA and SDO-AE scores did not show a link with risk taking in the domains other than the social domain (**Table 4.1b**), they could still influence the link between overall risk taking and creativity through a causally independent moderation effect. Hence the present study tested these additional effects in models 3 and 4 (**Figure 4.2**). The regression model predicting creativity, with average risk taking, RWA and an interaction term as the predictors was statistically significant [F(3,402) = 18.66, p < 0.001, R^2 = 0.116]. RWA was a significant predictor of creativity (b = -0.71, t(402) = -5.04, p < 0.001), as was the average risk taking across the domains (b = 0.77, t(402) = 3.59, p < 0.001). Importantly, the interaction effect was also significant (b = -0.54, t(402) = -3.35, p < 0.001). It was revealed through the Johnson-Neyman technique that when the RWA scores were 3.26 or lower (on a scale of 1 to 7), risk taking was a significant predictor of creativity (b = 0.46, t(402) = 1.96, p = 0.05). As the RWA scores decreased, the relationship between risk taking and creativity became more positive, with the lowest RWA score at 1 (b = 1.68, t(402) = 4.96, p < 0.001) (**Figure 4.4**). On the other hand, the regression model predicting creativity, with average risk taking, SDO-AE and an interaction term as the predictors was significant [F(3, 402) = 10.38, p < 0.001, R2 = 0.069]. SDO-AE was a significant predictor of creativity (b = -0.56, t(402) = -4.07, p < 0.001), as was risk taking (b = 0.83, t(402) = 3.72, p < 0.001). However, the interaction

term was not statistically significant (p = 0.126) thus revealing that unlike RWA, SDO-AE did not moderate the relationship between risk taking and creativity.

Figure 4.4 – Levels of RWA predict the relationship between risk taking and creativity



Levels of RWA for this figure were calculated from the 3-tile distribution of RWA scores with low (1-1.66), medium (1.66-3.5) and high (3.5-7) cut points.

4.4 DISCUSSION

"Probably about 20 to 25 percent of the adult American population is so right-wing authoritarian, so scared, so self-righteous, so ill-informed, and so dogmatic that nothing you can say or do will change their minds. They would march America into a dictatorship and probably feel that things had improved as a result. … And they are so submissive to their leaders that they will believe and do virtually anything they are told. They are not going to let up and they are not going away"

– Bob Altemeyer in "The Authoritarians"

(Altemeyer, 2006)

Altemeyer's quote on the right-wing authoritarianism reflects the impact that socio-political attitudes can have on shaping the course of a nation. Given the importance of socio-political attitudes, it is not surprising that its two major dimensions, the right-wing authoritarianism and social dominance orientation have been previously studied in

great detail. Although, previous research has found a negative association between RWA and divergent thinking, very little is known about its relationship with broader biographical dimensions of creativity. Additionally, the relationship between SDO and creativity remains unexplored. The present research thus aimed to investigate the nature of the relationship between socio-political attitudes and creativity. Additionally, given the importance of social risk taking in creativity, the present research also aimed to explore the relationship between domain specific risk taking and socio-political attitudes and a theorised mediating effect on creativity. This study was conducted on a large dataset collected from a group of participants based in the USA, a week after the presidential elections of 2016.

Consistent with the hypothesis, a negative relationship was found between the measures of socio-political attitudes and that of the creativity personality. RWA and SDO (dominance and anti-egalitarianism) demonstrated statistically supported negative correlations with CPS. A negative relationship was also observed between the CPS scores and the measures of conservatism (general, economic and social). This relationship was expected since a right-wing authoritarian, social dominance oriented and a conservative attitude is related to rigid beliefs about the world and a low tolerance to the alternative views; traits that are frequently identified in creative individuals and are important for originality. On the other hand, creative ideation did not show statistically supported correlations with either measures of socio-political attitude or those of conservatism. These differences between the creative personality and ideation scores highlight the importance of investigating the multi-dimensional nature of traits like creativity.

Furthermore, the findings from this study provided evidence for the hypothesised relationship between the socio-political attitudes and domain specific risk taking. The likelihood of social risk taking was found to be negatively correlated with measures of socio-political attitude and also with social conservatism. These results provide support

to the DPM model. This model proposes that differential socialisation practices in childhood are associated with socio-political attitudes (Duckitt & Sibley, 2010b). It could be argued that such childhood socialisation practices seem to give rise to the worldviews that the world is a dangerous and/or a competitive place as well as an aversion to social risks, both of which consequently show opposite, but consistent relationships with the socio-political attitudes. This argument is in line with the proposal that "RWA expresses the threat- and uncertainty-driven motivational goal or value of maintaining or establishing collective security (i.e. societal order, cohesion, stability, and tradition)" (Duckitt & Sibley, 2010a). Statistically supported relationships were also observed between social risk taking and measures of creativity. Linear regression models confirmed that only social risk taking predicted the creative ideation and personality scores. None of the other domains were significant predictors of creativity. These findings replicate the results reported in Tyagi et al (2017) and further establish the importance of social risk taking in creativity.

None of the other domains of risk taking showed significant relationships with authoritarianism or conservatism. However, financial, health-safety and ethical risk taking were found to be positively correlated with social dominance orientation. Previous studies have indicated that high-SDO individuals tend to be 'hierarchy enhancers' i.e. they tend to gravitate towards hierarchy enhancing careers in law, politics, law enforcement and business (Pratto et al., 1994). It is thus unsurprising to find that high-SDO individuals are also more likely to use deception, risk financial investments and indulge in health and safety based risks; the types of risks which are commonly found at the heart of these hierarchy enhancing careers. These findings warrant detailed future investigations to delineate the nuances of these relationships.

The present study also found statistically supported correlations among the measures of socio-political attitude. Although RWA and SDO are both faithful predictors

of prejudice and right-wing politics, and have previously been reported to be strongly correlated, they originate from different motivational goals or values. Evidence for this differential origin comes from a review of studies conducted on students' and parents' socio-political attitudes. Duckitt reported that while the correlations between students' RWA and SDO scores were weak and mostly non-significant, those between parents' RWA and SDO scores were relatively stronger (Duckitt, 2001). He speculated that this 'age effect' arises due to the independent acquisition of RWA and SDO attitudes during childhood socialization (leading to weaker correlations). Once established during childhood, high RWA in adults is hypothesized to promote high SDO and vice-versa due to higher involvement of politics later in life. This seems plausible because "in most western societies, politics tend to be organised around a single broad left-right dichotomy with high RWA and SDO associated with political right and low RWA and SDO with the left". Since the present study was conducted in adults who were based in the USA, high correlations between RWA and SDO scores were expected which corroborated Duckitt's theory.

An extremely important implication of the DPM model is that RWA and SDO exert their effects on socially relevant outcomes such as prejudice and politics and that these effects differ systematically due to the differences in the motivational basis of RWA and SDO. This 'differential prediction hypothesis' of RWA and SDO suggests that (i) while individuals who are high in RWA and SDO should affiliate to the right-wing conservative political parties in general, they (ii) should differ in the kind of right-wing political party they affiliate to (Crawford & Pilanski, 2014). Furthermore, people who are high-RWA should affiliate to the parties that "emphasize law and order and defend traditional and religious values". On the other hand, people who are high-SDO should affiliate to the political parties that "favour competitively based social inequality, hierarchy, and group dominance (e.g. free market capitalism, anti-welfare policies, and

openly discriminatory policies toward disadvantaged, subordinate groups)" (Duckitt & Sibley, 2010b; Van Hiel & Mervielde, 2002b). In the USA, political parties are broadly arranged along the political left-right, with the Republican and Libertarian parties towards the right, and the Democratic and Green party towards the left end of this spectrum. Additionally, the Libertarians believe in free market economics, competitively based social inequality and individual freedom (*lp.org/platform*). On the other hand, the Republicans place an emphasis on free market capitalism while also focusing on the traditional and religious values (*republicanviews.org/republican-party-beliefs*). These beliefs were clearly reflected in the findings from the present research which provide evidence in favour of the differential prediction hypothesis. While the Libertarians and Republicans scored significantly higher than the Democrats and the Greens on RWA, the Republicans were significantly higher than the Libertarians on right-wing authoritarianism. On the other hand, while both the Libertarians and the Republicans scored significantly higher on SDO (on both dominance and anti-egalitarianism subscales) as compared to the Greens and the Democrats, the Libertarians and Republicans were not significantly different from each other on their social dominance orientation scores.

Due to the differences in RWA and SDO scores across the political parties and due to the negative relationship between right-wing attitudes and creativity, differences in creativity scores across the political parties were found. Individuals who were affiliated to the Republican party generally scored lower on creative personality and creative ideation. Statistically significant differences were found, with Democrats scoring higher than the Republicans on creative personality; and the Libertarians and the Greens scoring higher than the Republicans on creative ideation. Similarly, socio-political attitudes also showed a negative relationship with social risk taking. This was also reflected in the findings; the Greens were more likely to take social risks as compared to the Republicans.

RWA, SDO-D and SDO-AE were all found to be partial mediators of the relationship between social risk taking and creativity. This implies that social risk taking partially exerts its effect on creativity through socio-political attitudes. These results were consistent with the hypothesis proposed in the current research that (i) high RWA might limit the positive effects of social risk taking on creativity by suppressing the likelihood of questioning norms and traditions (thereby decreasing novelty) and that (ii) high SDO might limit the positive effects of social risk taking on creativity by an aversion to risking social status. Although, in the absence of any experimental evidence, it is difficult to establish the temporal precedence of social risk taking over socio-political attitudes in the hypothesized mediation model, the DPM framework provides some important insights. Duckitt and Sibley (2010a) refer to the well-validated values-attitude-behaviour model of Homer and Kahle (1988). This model proposes that "causal influence flows from more abstract, broad-level cognitions (values) to mid-range, more specific cognitions (attitudes) to specific behaviours or outcomes, and that personality traits are causally antecedent to values". Thus, conceptualizing RWA and SDO as social attitude variables places them in the middle of the 'values-attitude-behaviour' causal chain. Future experimental studies should investigate the causal links between social risk taking and creativity and those of the factors that might affect this relationship.

Finally, the present study found evidence of a differential moderation effect of RWA and SDO on the relationship between the general likelihood of risk taking and creativity. The results of the moderation analysis suggested that although the likelihood of risk taking and creativity share a positive relationship (a consistent finding from the previous studies), this relationship only holds true for individuals with low or moderate RWA scores. For high-RWA people, the effect of risk taking on creativity was not significant. On the other hand, SDO was not a significant moderator of this relationship. These findings indicate that (i) reducing RWA (e.g. by increasing travel opportunities,

globalisation, international collaborations, multiculturalism, understanding and respect for other belief systems) and (ii) encouragement of social risk taking might hold the key to unleashing the creative potential of individuals in a social group. As Mark Twain puts it, “Travel is fatal to prejudice, bigotry, and narrow-mindedness”, traits that are negatively associated with creativity (Mark Twain, The innocents abroad 1869).

4.5 CONCLUSION

The present research aimed to investigate the effect of socio-political attitude on creativity and risk taking and the relationship between them. Right-wing authoritarianism and social dominance orientation were treated as attitudes and beliefs in the present study. This study is one of the first to report that creative personality shares a negative relationship with measures of socio-political attitude and those of conservatism, that social risk taking also shares a negative relationship with measures of socio-political attitude and measures of conservatism and finally that socio-political attitude mediates the positive effect of social risk taking on creativity.

CHAPTER FIVE

GENERAL DISCUSSION

The main objective of this thesis was to examine the relationship between domain specific risk taking and creativity. This was achieved through various sample populations in which individuals belonged to diverse groups and differed in their sexual orientation and socio-political preferences. This chapter presents a discussion of this investigation. The methodology applied in this thesis and the corresponding findings suggest recommendations for the future studies. These are discussed at the end of this chapter.

5.1 CREATIVITY AND RISK TAKING

Creativity has been a subject of scientific discussion for many decades and is often seen in the light of two related but independent qualities – Originality/Novelty and Usefulness/Appropriateness. This is often referred to as a standard definition of creativity and it provides the basis of the development of a wide variety of measures of creativity (Runco & Jaeger, 2012). A vast majority of these measures rely on a *controlled*, *divergent* production of *appropriate* ideas some of which could be novel, and thus creative (controlled production refers to a generation of related ideas as opposed to random ideas). Complementary to these approaches are those which require the test taker to associate concepts in a *remote* yet *appropriate* way which guarantees novelty and thus qualify as creative. These two approaches to measure creativity have been frequently employed in past studies since they allow a controlled estimation of the creative potential. However, these measures provide a unidimensional assessment of creativity by capturing the factors such as divergent thinking which are known to contribute to an individual's creativity. Additionally, these measures are performance based which makes them sensitive to experimental factors such as task performance anxiety. A broader range of measures exist

which aim to quantify the creative achievements, personality or the frequency of idea generation in an individual. These biographical measures of creativity provide a wider estimation of some of the other dimensions of creativity which are independent of the factors such as task induced anxiety. As opposed to the previous research methods, the current research investigated the relationship between creativity and risk taking by implementing a more holistic approach to measure creativity. This was achieved by employing a wide range of task based measures and questionnaire based measures of creativity. These include the alternate uses task, compound remote associates task, creative personality scale, Runco ideational behaviour scale and the creative achievement questionnaire.

Since by definition, novel ideas push the boundaries of conventionality, the reaction they will garner from the intended audience is often uncertain (Denham & Punt, 2017). Thus, production of originality requires individuals who are willing to take risks. Risk taking involves engaging in a situation which has a perceived uncertainty about the outcome of an action. It is thus highly intuitive to predict an effect of risk taking on the production of original ideas and in turn on creativity. This further becomes apparent upon an inspection of the acts of creativity in day-to-day scenarios. If a chef wants to *create* a *new* recipe, he/she would have to *experiment* with various ingredients or use new exotic ingredients, both of which qualify as acts of risk taking. Similarly, if an acclaimed dancer improvising on stage wants to *create new* sequences they would require a willingness to *risk* their status as an established dancer. It is thus perceivable to a creative person that their intended audience might mock, criticise or outright reject the creative product; or present a reward in a social, physical or financial domain.

Studies presented in chapter two found evidence of a strong and stable association between biographical inventory based measures of creativity and risk taking exclusively in the social domain of risk taking. All the other domains of risk taking did not show a

statistically supported correlation with measures of creativity. A linear multiple regression analysis showed that only social risk taking was a significant predictor of creativity as compared to the other domains of risk taking. These results from chapter two, were replicated in a different dataset, collected from another sample (from data presented in chapter four), thus providing further credence to these findings. A summary of the analogous results from the dataset employed in chapter four is provided below:

Table 5.1: Domain specific risk taking and creativity (replication)

Creativity	Risk	Likelihood of taking risks					
Measures	**Self-reports**	**Social**	**Recreational**	**Financial (gambling)**	**Financial (Investment)**	**Health & Safety**	**Ethical**
CPS	***.31***	***.38***	***.15***	***-.04***	***.15***	***.02***	***-.057***
	3.648e +7	1.211e +14	6.043	0.091	5.335	0.069	0.121
RIBS	***.27***	***.32***	***.3***	***.14***	***.21***	***.2***	***.17***
	406561	1.214e +8	5.022e +6	3.139	679.972	167.087	28.83

*These results replicate the findings presented in Table 2.2. Correlation matrix with Pearson's correlation coefficients (in bold, italics) and their respective Bayes factors underneath them. Statistically significant correlations are marked (**BF_{10} > 100). CPS=Creative Personality Scale, CAQ=Creative Achievement Questionnaire, RIBS=Runco Ideational Behavioural Scale. Only the likelihood of risk taking in the social domain significantly predicted both creative personality and ideational ability [CPS: $F(6,410) = 13.2$, $p<0.001$, $R^2 = 0.17$, standardized coefficient for social risk taking = 0.367, $p<0.001$; RIBS: $F(6,399) = 12.69$, $p<0.001$, $R^2 = 0.16$, standardized coefficient for social risk taking = 0.277, $p<0.001$]. None of the other domains of risk taking were significant predictors of these creativity measures.*

So why is it that of all the forms of risk taking, social risk taking is highly important in the context of creativity? An intuitive answer to this question appears from an understanding of the various domains of risk taking. As opposed to all the other domains of risk taking, social risk taking involves a chance of the acceptance or rejection

of an action from an individual, a small gathering or a large social group. It is further important to note that social risk taking is independent of the immediate social context since rewards (or punishments) can be temporally discounted. As discussed previously, all of this true for creativity as well. Generation of an original idea (or a creative product) underlies an inherent risk; a risk of that idea being accepted or rejected by some, or all the individuals forming the social group to which the idea was presented for evaluation; appreciation or criticism. Furthermore, like social risk taking, the rewards (appreciation) or punishment (criticism) related to being creative are temporally discounted. It is thus intuitive to predict that the cognitive processes underlying creativity might be shared by social risk taking (or more importantly, driven by it) and consequently it is not surprising to find a strong evidence of an association between the two traits.

Another interesting finding related to a lack of correlations between the domains of risk taking and scores on the performance based measures of creativity. This could be due to a variety of experimental factors; however, one of the following two explanations appear highly likely. This finding might simply relate to a lack of standardisation of these tasks based measures in different test settings (Bowden & Jung-Beeman, 2003; Guilford, 1967; S. A. Mednick & Mednick, 1967; E.P. Torrance, 1998). In the studies presented in this thesis, it is worth noting that most of the participants reported that both the divergent thinking task (alternate uses task, AUT) and the remote associates task (compound remote associates task, cRAT) were extremely difficult. When enquired about their experience with cRAT, they often reported that the words presented in cRAT were too culture specific (for instance ‘crabapple’ was mentioned by many participants) or that the time allocated to solve each problem (15 seconds) was too short. Similarly, they reported that in AUT, they did not often report the more violent ideas (such as throwing a brick at someone) since it would not be an appropriate answer. As opposed to this pragmatic explanation, a more theoretical explanation is also likely. As discussed previously, these

tasks are performance based measures of creativity. Thus, they measure the dimensions of creativity which are usually short-term and performance based. On the contrary, biographical measures of creativity aim to deliver a more long-term, achievement and personality based assessment of creativity. It is thus plausible that the short-term, laboratory based tests of creativity capture constructs which do not involve the same level of risk taking as the constructs which are assessed through the biographical measures of creativity. Studies in the future could benefit from investigating the specific relationships between various dimensions of creativity and other behavioural traits. It would also be interesting to test these associations in sample populations other than the American samples in which most of these tests were standardised. These results principally highlight a superior efficiency and sensitivity of the holistic measurement approach to creativity when compared to the previous approaches. I encourage the future investigations to employ utilising this approach in their studies.

Risk taking was also found to predict creativity in various multiple regression models and path analyses (mediation and moderation analyses) throughout this thesis. The theoretical basis of modelling risk taking as a predictor of creativity was twofold. Primarily, the well validated value-attitude-behaviour model proposes that the causal influences flow from more abstract values (broad cognitions) to mid-range, more specific cognitions (attitudes) to specific outcomes or behaviours (Homer & Kahle, 1988). Furthermore, personality traits are causally antecedent to values. Biographical measures of creativity are specific outcomes or behaviours (such as an individual's achievements or the number of creative ideas they generate weekly). In comparison, risk taking attitudes map well onto the mid-range cognitions, while traits like sexual orientation are highly stable and precede both risk taking and creativity in the causal chain. Adding to these theoretical bases, experimental evidence also suggests that experimentally manipulating risk taking in participants demonstrates a related change in their creativity (Gino &

Wiltermuth, 2014). Thus, multiple regression analyses with various domains of risk taking predicting creativity were conducted. Both study 1 and 2 in chapter two (as well as those in chapter three) found that of all the domains of risk taking, only social risk taking was a significant predictor of creativity.

The findings from chapter two indicated a strong link between social risk taking and biographical inventory based measures of creativity. Although the multiple regression analysis pointed towards the role of social risk taking as a predictor of creativity, these results were correlational in nature. To determine the causal influence of one variable on the other, experimental manipulation of the causal variable is necessary. In the absence of a standardised procedure which is able to manipulate social risk taking under experimental conditions, it is very difficult to assert with certainty that social risk taking influences creativity. However, an alternate approach to investigating the nuances of this association could be to investigate group differences in individuals in which both risk taking and creativity are known to vary. One such group of individuals is the sexual minority who have been previously shown to indulge in high risk taking activities such as illegal drug/ alcohol abuse and unsafe sexual encounters (Austin et al., 2004; Busseri et al., 2008; Cochran, Keenan, Schober, & Mays, 2000; Corliss et al., 2010; Drabble, Midanik, & Trocki, 2005; Garofalo et al., 1998; Hatzenbuehler, Jun, Corliss, & Austin, 2015; King & Nazareth, 2006; Lindström et al., 2014; Rice et al., 2013). This group is also often speculated to be highly creative (Ben-Zeev et al., 2012; Carter, 1985; Charyton, 2007; Demb, 1992; Vuksanović et al., 2014). I thus investigated the nature of the link between domain specific risk taking and creativity in sexual minority.

The two studies presented in chapter three found contradictory results. This can be largely attributed to the small number of bisexual and homosexual individuals who volunteered for study 1. Owing to this small sample size, the statistical models of the analyses of variance in study 1 did not show any group differences in participants' scores

on measures of creativity and risk taking. In addition to the small number of participants, assessing sexual orientation in a laboratory based study is also problematic. This is mainly due to the stigma associated with being a sexual minority and a fear of judgment which can lead to dishonest responses on the questionnaires and anxiety on the performance based tasks such as the picture preference judgment task. This became evident in the findings from study 2 which was conducted on a larger, more diverse group of individuals on a platform which guarantees anonymity. In line with the hypotheses and findings from previous literature, group differences were found among various sexual orientation groups on the measures of creativity and that of risk taking. Bisexual individuals scored higher on self-reported creativity, personality and Runco ideational behavioural scale when compared to the asexuals and heterosexuals. These results corroborate recent findings which investigated creativity in sexual minority using different measures of creativity (Ben-Zeev et al., 2012; Noor et al., 2013). Homosexuals were more likely to take risks in the recreational and health/ safety domains when compared to asexuals. Furthermore, they are also more likely to take ethical and financial risks as compared to the heterosexuals. However, no significant differences were found in the likelihood of social risk taking between homosexual, bisexual and heterosexual groups. Despite a lack of group difference, all the groups reported the highest likelihood of risk taking in the social domain. Thus, it appears that the differences in creativity among the sexual orientation groups did not relate to the differences in social risk taking. However, the likelihood of domain general risk taking (guided by the risk domains such as health/ safety) seemed to demonstrate an association with differences in creativity among the groups. This was confirmed by the results from the mediation analysis. Domain general risk taking was found to partially mediate the effect of sexual orientation on creativity.

Another context in which both risk taking and creativity are known to vary is differences in socio-political ideologies. It has been theorised that individuals who

affiliate to the right-wing ideologies and political parties might score lower on the measures of creativity. This might be due to the importance of openness to new experiences and preference of complexity over simplicity in creativity, traits which are previously known to contradict the right-wing ideologies (Eisenman, 1992; Van Hiel et al., 2010). Findings presented in chapter four indeed showed a differential effect of the affiliation to various political parties in the Unites States of America. The political party system in the USA allows for an investigation of these effects since it is mainly a two-party system and is generally organised along the left-right political spectrum (Darlington, 2017). The democrats and the greens scored significantly higher on the creative personality scale and creative ideation score as compared to the republicans. As predicted, republicans and libertarians were high on right-wing authoritarianism, social dominance orientation and conservatism.

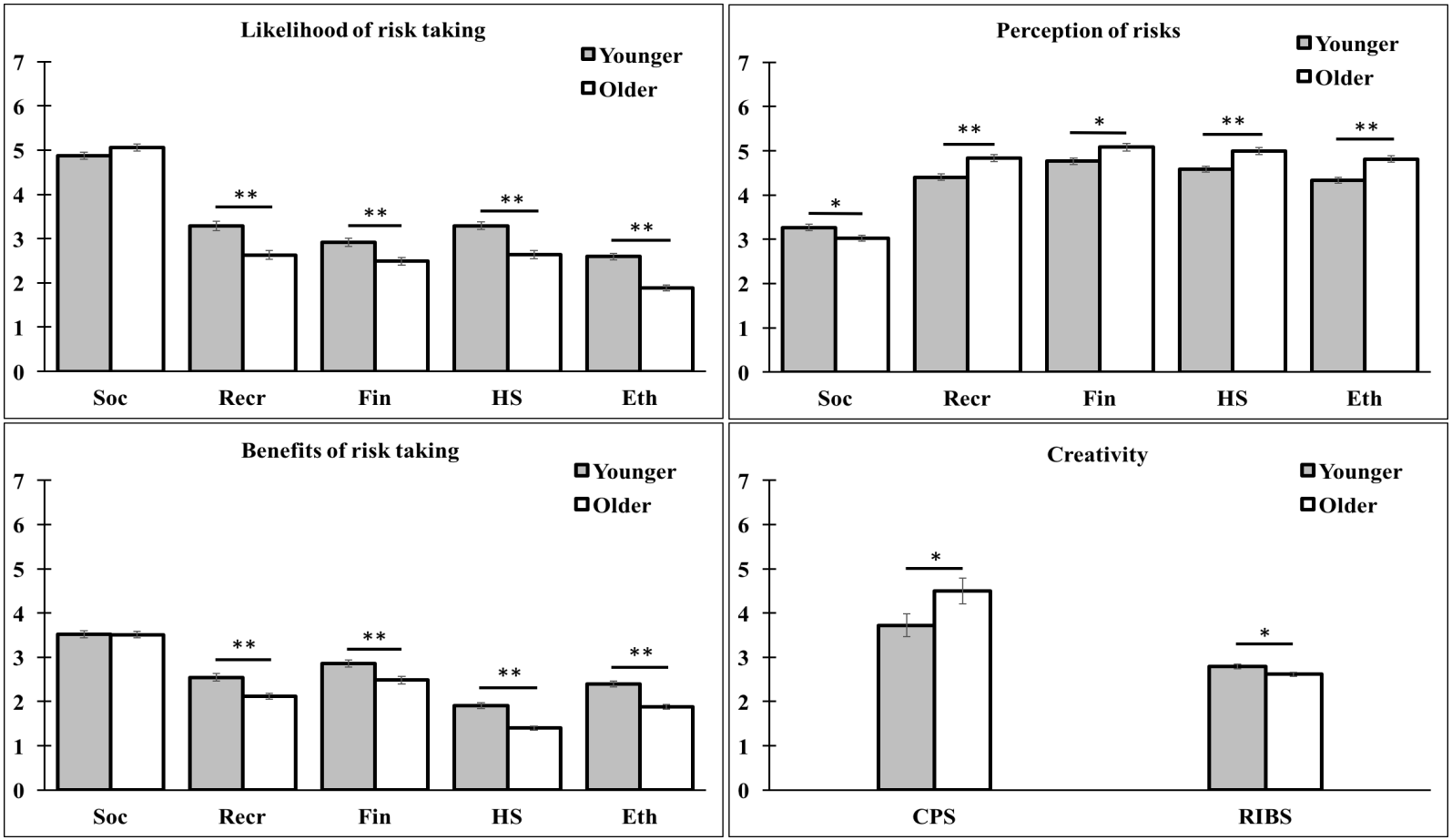
Furthermore, the development of right-wing ideologies through punitive and unaffectionate childhood socialisation practices might additionally contribute to a lower likelihood of social risk taking in these individuals while increasing the likelihood of some of the other forms of risk taking such as health/ safety. If this were true, this will have a negative impact on the scores on creativity measures. Indeed, social risk taking was found to be higher in the greens as compared to the republicans, while all the other domains of risk taking did not reveal any differences among the individuals affiliating to various parties. In addition to these group differences, path analysis yielded a partial mediation effect of both the measures of socio-political ideologies on the causal link between social risk taking and creativity. Finally, a moderation analysis revealed that high scores on the right-wing authoritarianism scale predict lower scores on creativity, independent of the amount of risk taking likelihood. These results further enrich our understanding of the factors involved in influencing creativity and strengthen the previous results establishing an association between creativity and risk taking especially in the

social domain. They also warrant further disentanglement of the causal link between social risk taking and creativity.

It is important to discuss a set of findings which although were not directly related to the main objectives of this thesis (and hence were not presented in previous chapters), they lead us to a better understanding of the development of social risk taking in adolescents and adults. In order to determine an effect of age on the findings presented in this thesis, a set of t-tests were conducted on the likelihood of risk taking in each of the five domains between younger and older participant groups. This was accompanied by a set of t-tests on risk perception and benefits as well as on the biographical measures of creativity. The younger and the older age groups were defined through a median split analysis. In essence, the sample population with an age range of 18 to 73 years (average age of 36 years) was split along the median to form a *younger* age group (age range 18-32 years) and an *older* age group (age range 33-73 years). These two groups were then analysed for statistically significant differences in their mean scores on various measures of risk taking and creativity. The dataset for this analysis originated from Study 2 presented in chapter two. The number of individuals falling in each of the two age groups were 209 for the younger group and 208 for the older group. The findings from these analyses are presented in **Figure 5.1**. As predicted, individuals in the younger age group were more likely to take risks in all the domains except the social domain (recreational $t(415) = 4.6$, $p < 0.001$; financial $t(415) = 3.42$, $p < 0.001$; health/ safety $t(415) = 5.22$, $p < 0.001$ and ethical $t(415) = 6.92$, $p < 0.001$). Although the difference in the age groups in the social domain did not reach statistical significance, the difference was marginally significant ($t(415) = -1.68$, $p = 0.092$) and more importantly, the direction of this effect was reversed (i.e. individuals in the older age group were more likely to take social risks as compared to the younger age group). This effect became more evident in the perception of risks in these two groups across the five domains. Individuals in the younger age group

perceived social risks to be significantly higher than the older age group ($t(415) = 2.39$, $p = 0.017$). Furthermore, individuals in the younger age group perceived all the other forms of risks to be significantly lower than the older age group (recreational $t(415) = -3.97$, $p < 0.001$; financial $t(415) = -2.83$, $p < 0.001$; health/ safety $t(415) = -3.93$, $p < 0.001$ and ethical $t(415) = -4.79$, $p < 0.001$). These effects were also reflected in the perception of benefits associated with taking risks in each domain.

Figure 5.1: Effect of age on measures of risk taking and creativity.



*T-tests between younger and older participant groups on the measures of creativity and risk taking. Soc = Social, Recr = Recreational, Fin = Financial, HS = Health/ Safety, Eth = Ethical, CPS = Creative personality scale, RIBS = Runco ideation behaviour scale (*p < 0.05, **p < 0.001).*

This age effect on the risk taking in younger adults when compared to older adults has been studied under related labels. One of the most common explanations provided in the previous literature for these effects is through an effect known as *peer effect*. This effect is often studied in adolescents and young adults and refers to increased likelihood of risk taking in participants when they are actively advised by peers, observed by peers or even simply are in the presence of peers (Chein, Albert, O'Brien, Uckert, & Steinberg, 2011; M. Gardner & Steinberg, 2005; Haddad, Harrison, Norman, & Lau, 2014; Noval & Mitchell, 2003; Simons-Morton, Lerner, & Singer, 2005). Importantly, younger participants are more likely to be affected by the peer effect as compared to the older adults (M. Gardner & Steinberg, 2005). It is important to note that previous studies on the peer effect were conducted exclusively in the health/ safety or financial domain. Findings presented here from other domains are relatively novel.

The lower rate of social risk taking in younger individuals is intuitively in line with the conceptualisation of social risk taking. For instance, it is important to speak your mind in a peer group where speeding a car for thrills or consuming illegal drugs is being discussed/offered. However, this proves to be extremely challenging especially in young individuals where jeopardising one's social status can have profound impact on the involvement of the individual in the social group. Since the effect of peer pressure is decreased in older adults, perception of social risks is decreased and this consequently might lead to increased likelihood of social risk taking in older adults.

Finally, based on the findings from this thesis, a lower social risk taking in younger adults should have an impact on the creativity scores in these individuals. As reported in **Figure 5.1**, this is indeed the case with creative personality scores. Younger adults score significantly lower on the creative personality scale as compared to the older adults. However, this effect is reversed in the creative ideation scores. A likely theoretical explanation for this difference originates from the structure of the creative ideation scale.

RIBS, the scale used for measuring creative ideation explicitly asks the individuals to "Note the focus on their thinking, which might be different from their actual behaviour". Therefore, individuals report the frequency of idea generation as opposed to idea expression. It is intuitive to predict that the amount of social risk taking involved in generating an idea is inherently lower than the amount involved in expressing an idea. As a consequence, although younger individuals are less likely to take social risks and score lower on creative personality, yet they generate creative ideas more frequently. If this hypothesis finds experimental support in future studies, it could provide strong evidence that social risk taking plays the role of a gate keeper in the expression of creative ideas.

5.2 LIMITATIONS, RECOMMENDATIONS AND FUTURE DIRECTION

Although this thesis provides strong evidence for a domain specific relationship between risk taking and creativity and benefits directly from the causal theoretical models, it has its limitations. The following section provides a discussion of these limitations and suggests directions for future investigations.

5.2.1 CORRELATIONAL NATURE OF OBSERVATIONAL STUDIES

Despite a high reliance of the studies presented in this thesis on experimental methodologies, most of the major findings reported here are derived from observational datasets. This is similar to a major section of the previous literature on creativity which is observational in nature (experimental manipulation of creativity has its own major limitations, these are however not discussed here). A higher involvement of observational data over experimental manipulations in these studies could be mainly attributed to the following three factors:

(i) Abstractness of both creativity and risk taking:

As is evidenced from the previous discussions in this thesis, both creativity and risk taking are abstract traits. They are higher order cognitive traits which arise from a possible interplay of a multitude of other lower order cognitive functions. For instance, creativity has been hypothesised to involve an ability to remotely associate concepts (S. Mednick, 1962), an ability for divergent thinking (Guilford, 1950), problem solving (Fink, Benedek, Grabner, Staudt, & Neubauer, 2007; Weisberg, 1988) and other modality specific functions such as visual processing or auditory processing (for example, creativity in painters and musicians). Similarly, risk taking has been shown to involve reward sensitivity, sensation seeking, impulsivity and so on (Steinberg, 2008). Due to this abstract nature of creativity and risk taking, it has been extremely challenging to design focused, reliable and valid task based measures of these constructs. This consequently leads to a difficulty in manipulating these variables in a laboratory setup.

(ii) Lack of standardised measures of creativity:

Over the decades, the definition and conceptualisation of creativity has changed dramatically. From early proposals by Guilford in the form of divergent thinking to the latest developments in remote association based measures such as cRAT, investigators have relied on a narrow, unidimensional view of creativity. Despite several attempts at capturing the holistic character of creativity (for instance Glăveanu & Lahlou, 2012), most of the literature has ignored the advantages of viewing creativity through a multidimensional lens. This is mostly due to the methodological limitations such as run time of the experiments. Consequently, this leads to a potential issue. Investigators are faced with a choice between capturing creativity as a multidimensional trait by relying on small and easy to complete questionnaires (yielding the observational data) over treating creativity as a unidimensional trait and utilising an experimental approach which is usually long and complicated (from a participant's perspective).

(iii) Biographical versus experimental approaches to creativity:

In previous experimental approaches, creativity has been measured as a performance based behaviour. However, creativity also manifests itself in the form of long term behaviour changes and outcomes. These could be conceptualised as creative achievements, personality or frequency of ideas etc. By nature, it is impossible to capture biographical measurement of creativity in an experimental approach. A researcher has to purely rely on questionnaires leading to the observational data.

Despite the fact that observational data provides high flexibility and that it is practically superior than experimental data, it has a major limitation. Observational data is correlational by nature. Any inference of causality is theoretically driven and requires experimental evidence to support itself. This is indeed the case with studies presented in this thesis. For instance, although ample evidence suggests that creativity is linked with domain specific risk taking, the direction of this association has not been established. Does risk taking behaviour in individuals influence their creativity or is it the opposite? Dellas and Gaer (1970) provided some support to the notion that it is the personality traits that affect creativity in individuals, not the opposite. This is also in line with the well-validated values-attitude-behaviour model of Homer and Kahle (1988). This model proposes that "causal influence flows from more abstract, broad-level cognitions (values) to mid-range, more specific cognitions (attitudes) to specific behaviours or outcomes, and that personality traits are causally antecedent to values". Thus, it is likely that risk taking attitudes in certain domains influence creativity. Finally, it has been shown through experimental manipulations that modifying risk taking (ethical risk taking to be specific), modifies creativity in adults (Gino & Wiltermuth, 2014). It is thus recommended that future investigations should aim to manipulate both creativity and risk taking in various domains since this would unravel the exact nature of the causal link(s) between these two

variables. Such studies might subsequently prove to be extremely important in finding ways to foster creativity.

5.2.2 Lack Of A Standardised Measure Of Social Risk Taking

In a manner similar to creativity, specific domains of risk taking such as social risk taking or recreational risk taking do not have dedicated standardised measures such as experimental tasks or questionnaires. In the past, risk taking has been mainly studied through experimental tasks which measure risk taking in either financial or health/ safety domain (Bechara et al., 1994; Lejuez et al., 2002; Studer & Clark, 2011; Zuckerman & Kuhlman, 2000). Arguably, this could be due to the higher reported rates of risk taking in the health/ safety domain or the more severe consequences of risk taking in health/ safety domain (for instance road accidents or drug overdose) (Crime Survey for England and Wales 2015/16, Health and safety statistics 2015/16, Statistics on Drug Misuse 2016). Furthermore, this could also be due to the *gamification* of the risk taking in the financial domain and consequently its greater social acceptance (for instance gambling in casinos or betting on horse racing) (Bechara et al., 1994; Studer, Apergis-Schoute, Robbins, & Clark, 2012). Whatever the reason, it is beyond doubt that risk taking in the social domain has received much less attention as compared to the other domains of risk taking. This has led to a lack of measures available for investigating social risk taking in either experimental or observational paradigms.

DOSPERT, the questionnaire used in the studies reported in this thesis, aims to measure risk taking in each of the five domains. Despite its high reliability and validity, the main objective of DOSPERT is to study all domains of risk taking simultaneously, using the collection of six items from each domain as subscales. This proves effective for an exploration of associations such as the one explored in chapter two of this thesis. However, highly specific and more detailed questionnaires are required to investigate the nuances of such associations. Given the high relevance of social risk taking in creativity

and in general, it is recommended that future psychometric studies aim at developing detailed questionnaires to capture various aspects of social risk taking.

In conjunction with the questionnaires, experimental approaches to investigating social risk taking (and the role of social risk taking in creativity) are much needed. During the course of my PhD, I had the opportunity to conceptualise and design a task based measure of social risk taking. Along with my PhD supervisor Prof. Denham and internal collaborator Prof. Hanoch, I submitted a postdoctoral funding proposal for investigating social risk taking and its role in creativity. This experimental task has been termed the Idea Investment Game and I hope to develop, standardise and publish this task in the future studies. A brief summary of this task is provided as follows.

The Idea Investment Game (IIG) will be developed using animated characters in a social scenario. This task is expected to serve as a standard behavioural measure of social risk taking to be used in the future studies of social risk taking. This game will be developed such that it could be deployed on a virtual reality machine as well as on a computer screen. The rationale behind this task is to estimate the extent of social risks that an individual takes while submitting their creative ideas to a set of peers for evaluation. There are four phases in this game.

(i) Preparation: Before attending the experimental session, participants will be given a scenario. In this scenario, they will be told that their peer group is going out in the town to have fun. They will be asked to think of 5 creative ideas which will help them and their peers to have a good time. They will then rank their own ideas on a scale of 1 to 5 (1 being the weakest and 5 being the strongest idea). Upon their arrival on the day of the experiment, they will be informed that their ideas were anonymously given to their peers who rated these ideas on ‘how strong these ideas are’. Additionally, their peers gave stars to the participants based on how popular they are in their peer group. Furthermore, they will be presented with five of those peers at a time in each round of the game.

However, to avoid bias, they will be presented with moving avatars (animated characters) of these peers.

(ii) Selection: In each trial, the participants will select one of their ideas to present in front of the peer group. The objective of the game is to gain popularity in the peer group (by gaining more stars). If they submit the strongest idea and if that idea is accepted by a majority of their peers, they will be rewarded with a higher number of stars. However, if they get rejected, they will lose an equally higher number of stars.

(iii) Feedback: Finally, in each trial, participants will be made aware of the decision taken by the peer group and will receive an increase or a decrease in the number of stars depending on the outcome of the trial. In each feedback, they will also be actively made aware of the significance of the stars as a popularity measure in their peer group.

(iv) Scoring: The total number of ideas multiplied by the strength of ideas 'invested' in this game will provide a comprehensive score of an individual's social risk taking. Additionally, a score of the adjustment to social risk will also be calculated (as measured by the rate of a decrease in their investment with an increase in risk).

I expect to establish the reliability and validity (convergent and divergent) of the Idea Investment Game and aim to provide an open-source, standardised measure of social risk taking in adolescents and adults.

5.2.3 Cross-Cultural Validity Of The Current Findings

A final limitation in this discussion relates to the cross-cultural validity of the findings reported in this thesis. It is worth pointing out that most of the data for these studies came from the sample populations based in the United States of America. This was intentional since most of the measures used in these studies have previously been standardised for this population. However, as a consequence, similar to the previous studies the current findings also suffer from a limited validity. Inferences on other sample populations cannot be drawn especially if the other sample populations strikingly differ

from the US sample. This is true for most collectivistic cultures such as India where tighter social structures might highly influence the consequences of social risk taking as well as the consequence of being creative. Even within two highly individualistic cultures (such as the UK and USA), cultural differences were observed in the current studies, such as the differences in the number and type of ideas generated in the divergent thinking task (AUT). For example, participants in Georgia, USA were more open and confident in their responses as compared to the participants in Plymouth, UK; even though they shared a laboratory space with other people at Georgia. Furthermore, participants in Plymouth simply refused to report violent ideas since they were categorised as 'inappropriate'.

Finally, this limitation also applies to the categorisation of socio-political attitude as well as of sexual orientation in the current studies. In some societies, sexual minority are treated with hatred, ostracism and criminal charges while in others they are fighting for equality and respect. These differences might underlie the differences in risk taking and those in creative output and its social approval/appreciation in different cultures. Similarly, it would be interesting to investigate cultural differences in societies where the political environment unlike the USA, is not mainly two-party based. Thus, it will be highly useful to replicate the current findings in datasets obtained from different cultures in order to establish their cross-cultural validity in future studies.

5.3 FUTURE PROPOSALS

As discussed previously in greater detail, a strong age effect is observed in various domains of risk taking in young adults when compared to the older adults. While the likelihood of social risk taking is lower in young adults, other forms of risk taking with more negative consequences (such as health/ safety) are higher in young adults. As a child enters adolescence, the tendency to take health-safety and financial risks shows a remarkable increase (Steinberg, 2008). Research has revealed the peer effect as a possible mechanism driving a sudden increase in this behaviour (violence, sexual risk taking and

drug and alcohol abuse). Risk taking behaviour increases when adolescents are actively advised by peers (M. Gardner & Steinberg, 2005; Haddad et al., 2014), observed by peers (Chein et al., 2011; Haddad et al., 2014) or even simply are in the presence of peers (Noval & Mitchell, 2003; Simons-Morton et al., 2005). This effect is known to peak and then diminish with age. In the past, attempts have been made to utilise this knowledge through educational programs in order to minimise the risky behaviour in adolescents (Steinberg, 2008), albeit to a minimal success.

It is likely that the limited success in the efforts to reduce health & safety related risk taking in adolescents might be mediated by a simultaneous increase in the perception of social risks. "That's cool, you should try it", "C'mon let's do it", "Don't chicken out now" and "Let's go faster" are some of the frequently used phrases by adolescents while engaging in health and safety risks. Individuals take extreme health and safety risks in order to 'impress' their peers, sometimes risking losing limbs or worse, their lives. A choice between risking the social status in a group and taking health and safety risks often motivate adolescents (and sometimes even adults) to prioritise the latter over the former. In fact, studies show that this is indeed the case in children and adolescents (Prinstein & Cillessen, 2003; Rose, Swenson, & Waller, 2004). In the future studies, an investigation of the manipulation of social risk taking in adolescents might shed light on the underlying causes of the increased health & safety related risk taking behaviour. This will bring us one step closer to devising educational, social and intervention policies for reducing negative risk taking in adolescents.

5.4 Impact Of The Current Research

5.4.1 On The Current Understanding Of Creativity

Creativity lies at the heart of all innovations. It is thus extremely important to understand how creative ideas are generated and how creativity can be fostered at an early

stage in life. Past research has explored a plethora of factors which affect creative production in individuals. The present research adds to those findings and suggest an important role of social risk taking in creativity. This research thus contributes to the existing scientific literature on creativity thereby allowing future investigations to delineate the precise causal role that social risk taking might play in creativity. Consequently, it also opens the door to the development of intervention and educational strategies for fostering creativity in young adults and adolescents.

5.4.2 On The Current Understanding Of Social Risk Taking

Risk taking is an integral part of human behaviour – risk is vital for innovation, for example. However not all risk-taking is positive and adolescents are amongst the most likely groups to engage in negative risk-taking behaviour, the impact of which on health, education and job opportunities can be long lasting and profound. According to the Office for National Statistics, UK, the leading cause of death in 5-19 year olds was land transport accidents. Similarly, according to the World Health Organisation fact sheet (reviewed November 2016), the leading cause of death among young people aged 15-29 across the world was road traffic injuries. There is a clear need for understanding and mitigating the underlying causes behind this heightened health and safety related risk taking in young individuals. Past research has shown that social pressure from peers could be a strong predictor of such risk taking; i.e. the degree to which adolescents are willing to engage in social risk taking. Findings from the studies presented in this thesis contribute to a better understanding of social risk taking. The impact of this research will be two-fold: First this will further the current understanding of social risks and how individuals take them. This will open new avenues for future research and will invite researchers to investigate a multitude of various behaviours and neural processes that are affected by social risk taking. Secondly, this has the potential to be translated into educational and training

strategies which consequently will not only have an impact on reducing fatalities related to health-safety related risks but also on how we perceive social risks.

5.4.3 On The Current Understanding Of Creativity In Sexual Minority

In general, the scientific literature on various behaviours in sexual minority is mixed (Fredriksen-Goldsen & Muraco, 2010; Marshal et al., 2008; Ryan, Wortley, Easton, Pederson, & Greenwood, 2001). Adding to the mixed findings, literature on creativity in sexual minority is highly driven by stereotypes and speculations without much agreement in terms of scientific findings. Part of the problem lies in the extreme difficulty in the classification of sexual minority groups. This is in turn due to the social stigma associated with the phenomenon and fear of ostracism in sexual minority. Thus, there is a clear lack of systematic investigation of creativity in sexual minority. Any research on this topic thus has a high impact on the current understanding and treatment of differences between various sexual orientation groups and the factors underlying these differences. In addition, research on sexual minority opens up new avenues for an open discussion while simultaneously dispelling some of the myths associated with being a sexual minority.

Furthermore, the present research presents a clear evidence of the importance of parcelling bisexual group out of the LGB group. Unlike previous approaches, recent research in sexual minority has started treating bisexuality as an independent phenomenon and this thesis contributes to this much-needed shift. This will not only have a high impact on how the scientific community investigates bisexuality in the future studies, but also on how bisexual individuals are perceived in general in the society.

5.4.4 On The Current Understanding Of Creativity In Right-Wing Individuals

In the recent times, socio-political views, especially in the western world have shown that a clear divide exists between individuals affiliating to the left and right-wing ideologies. With strong socio-political viewpoints guiding the choice of leadership in various parts of the world, it thus becomes extremely important to understand the factors that affect these viewpoints or are affected by these. The current research presents evidence in favour of the hypothesis that individuals who subscribe to the right-wing side of the socio-political spectrum demonstrate low creativity. Furthermore, it shows that right-wing ideologies play a mediating role on the relationship between risk taking and creativity. The impact of such studies on the socio-political attitudes is twofold. Firstly, these studies highlight the fact that socio-political attitudes are not as strongly embedded in personality as they were thought to be by previous researchers thereby opening up avenues for an open discussion rather than outright dismissal of the right-wing ideologies and of individuals who affiliate to them. Secondly, these studies further our understanding of the factors which underlie social risk taking tendencies and creativity some of which originate from differences in childhood socialisation practices. In turn, these open up new ways to develop intervention strategies with an aim to foster creativity and mitigate social risk aversion especially in young adults.

5.5 CONCLUSION

The present research aimed to investigate the relationship between risk taking and creativity. It demonstrated that a strong link exists between social risk taking and creativity. It tested and highlighted the idea that an aversion to social risk taking stifles creativity. Finally, it opened up a discussion on how risk averse societies or societies with strong adherence to social conventions and norms (such as authoritarians) could become non-creative with the exception of the few people willing to stand outside the social norms.

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APPENDIX 1

PERSONALITY, CREATIVITY AND RISK TAKING

Big five personality factors have previously been implicated in both risk taking (Anic, 2007; Zuckerman & Kuhlman, 2000) and creativity (Ivcevic & Mayer, 2006); we investigated these factors in study 1 (chapter 2) with an aim to replicate these findings.

Big Five Inventory measures five dimensions of personality as proposed by Goldberg in 1993 (John, Robins, & Pervin, 2008). Each of these dimensions are one of the big five personality factors measured by this forty-four item inventory (BFI-44). These factors are Extraversion, Agreeableness, Conscientiousness, Neuroticism and Openness to experience. A ten-item short Big-five inventory (BFI-10) (Rammstedt & John, 2007) was administered in the current research. The results from this study corroborated previous findings and provided additional insights. In line with the previous studies, extraversion was found to be positively correlated with risk taking while neuroticism showed negatively correlations. More specifically, high extraversion was related to a higher likelihood of taking risks in ethical and health & safety domains. Low neuroticism on the other hand was linked to the higher likelihood of recreational risk taking **(Table Appendix 1)**.

Although these results added to the current understanding of the relationship between personality traits, domain specific risk taking and creativity, they did not specifically contribute to the initial aim of investigating the link between risk taking and creativity. Hence, the big-five questionnaire was excluded from subsequent studies.

Table Appendix 1: Cross-correlations among measures of big five personality, creativity and domain specific risk taking.

	Likelihood of taking risks						Creativity		
	Social	**Recreational**	**Financial (Gambling)**	**Financial (Investment)**	**Health & Safety**	**Ethical**	**CPS**	**RIBS**	**CAQ**
Extraversion	***0.294***	***0.322***	***0.158***	***0.087***	***0.441******	***0.419****	***0.364***	***0.132***	***0.065***
	2.372	4.216	0.334	0.196	104.364	52.147	11.136	0.265	0.177
Agreeableness	***-0.006***	***0.18***	***0.033***	***0.01***	***-0.012***	***-0.004***	***0.222***	***-0.087***	***0.103***
	0.156	0.418	0.161	0.157	0.157	0.156	0.714	0.196	0.214
Conscientiousness	***-0.081***	***0.033***	***0.067***	***0.149***	***-0.042***	***0.071***	***0.022***	***0.088***	***0.211***
	0.19	0.161	0.179	0.305	0.165	0.181	0.158	0.197	0.613
Neuroticism	***-0.155***	***-0.413****	***-0.086***	***-0.154***	***-0.237***	***-0.255***	***-0.339***	***0.026***	***-0.127***
	0.324	42.943	0.195	0.32	0.89	1.173	6.062	0.159	0.255
Openness	***-0.004***	***-0.079***	***-0.049***	***-0.015***	***0.072***	***0.018***	***0.166***	***0.272***	***0.121***
	0.156	0.188	0.168	0.157	0.183	0.158	0.361	1.571	0.243

Correlation matrices with Pearson's correlation coefficients (in bold, italics) and their respective Bayes factors underneath them. Statistically supported correlations are marked (BF_{10} > 30, **BF_{10} > 100).*

APPENDIX 2

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The Risky Side of Creativity: Domain Specific Risk Taking in Creative Individuals

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Risk taking is often associated with creativity, yet little evidence exists to support this association. The present article aimed to systematically explore this association. In two studies, we investigated the relationship between five different domains of risk taking (financial, health and safety, recreational, ethical and social) and five different measures of creativity. Results from the first (laboratory-based) offline study suggested that creativity is associated with high risk taking tendencies in the social domain but not the other domains. Indeed, in the second study conducted online with a larger and diverse sample, the likelihood of social risk taking was the strongest predictor of creative personality and ideation scores. These findings illustrate the necessity to treat creativity and risk taking as multi-dimensional traits and the need to have a more nuanced framework of creativity and other related cognitive functions.

Keywords: creativity, risk taking, domain specificity, social risks, DOSPERT

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INTRODUCTION

The great sculptor, painter, and architect, Michelangelo frequently depicted the sensual form of human bodies in religious contexts such as in his masterpiece, 'David'. In one incident, his fresco, 'The last judgment' was highly criticized by the then Pope's master of ceremonies since it "depicted. . .nude figures, exposing themselves" (Land, 2013). Michelangelo responded by painting the official's face into the mural and covering his nude figure with a snake. Anecdotes such as this have provided support for the notion that creative individuals are risk takers. In his seminal work, McClelland proposed that 'a calculated risk' is an important aspect of scientific performance (McClelland, 1963). Other writers have expressed similar views (Sternberg and Lubart, 1995; Sternberg, 1997; Runco, 2015; Steele et al., 2016), calling a creative act a risk (Haefele, 1962), as well as referring to the willingness of creative individuals to risk the uncertainty of the unknown (Getzels and Jackson, 1962). Despite these suggestions, most of the literature is speculative in nature and little empirical data exists to support such claims. To bridge this gap, we investigated whether creativity is associated with risk taking; more importantly, we specifically examined the link between creativity and risk taking in five different domains or content areas.

Early scientific investigation of risk taking in the context of creativity was an exploratory study conducted by Merrifield et al. (1961). They found a significant correlation between participants' associational fluency (a measure of divergent thinking based assessment of creativity) and their score on adventure as a component of risk taking. Building on this work and McClelland's speculations, Pankove and Kogan (1968) conducted a study among fifth grade children. They measured creative ability with divergent thinking tasks which involve generating as many solutions to open-ended problems as possible. Risk taking was measured by a variety of behavioral tasks

which were hypothesized to involve certain degrees of risk. The researchers reported a significant relationship between risk taking and creativity only when risk was measured by one of the tasks. The other measures of risk taking did not yield any evidence of a relationship between risk taking and creative ability.

Other researchers have investigated the relationship between creativity and risk taking using related but indirect measures. Fleming and Weintraub (1962), for instance, found an inverse relationship between rigidity and intolerance of ambiguity as a measure of risk and creativity, in elementary school children. Similarly, Kurtzman (1967) measured adventurousness as a personality characteristic and used several tests from the *kit of reference tests for cognitive factors* to measure creativity (Ekstrom et al., 1976). He did this study on ninth grade girls and found that highly creative girls were significantly more adventurous than the less creative. Nicolay (1966), on the other hand, reported a lack of significant correlation between risk taking and creativity in female undergraduates.

A growing body of recent literature has also reported mixed findings when measuring risk taking and creativity under specific conditions. For example, Ivcevic and Mayer (2006) measured three dimensions of creative behavior – creative life style, performing arts and intellectual achievement using the *life report questionnaire* (Ivcevic and Mayer, 2009). Monetary risk taking was also measured using the *Risk taking Personality Inventory* which measures risk taking in five domains. They found that the individuals who scored high on intellectual achievement exhibited high risk taking tendencies in the professional and financial areas. In contrast, Erbas and Bas (2015) did not find any significant correlations between the creative ability as measured by the *Creative Ability in Mathematics Test* and academic risk taking as measured by the *Academic Risk Taking Scale* among ninth graders. The aforementioned studies clearly demonstrate a lack of consensus regarding the relationship between risk taking and creativity. Some report a small positive correlation while others find no significant relationship between various measures of creativity and risk taking. As pointed out by Strum (1971), this lack of consensus may be attributed to the specific methods used to measure creativity and risk taking, diversity in the definition of risk taking, differences in the number of participants and other aspects of demographics, including cultural differences. Such varied and differentially motivated research warrants an obvious, yet important question: Are creative individuals high risk takers?

In order to answer this question and to address earlier shortcomings, in the current investigation we used a wider range of standardized performance and questionnaire based instruments to obtain comprehensive measures of creativity and risk taking. Measuring creativity has been an exceptionally challenging task throughout the history of creativity research. Although numerous attempts have been made to measure different dimensions of creativity, they are marred with criticism. Past studies which aimed to explore the relationship between creativity and risk taking have equated creativity to measures such as associational fluency, divergent thinking, tolerance of ambiguity, creative lifestyle or intellectual achievements. Each of these measures only provide a narrow insight into some aspects of creativity. Contrary to the previous studies, we treated creativity as a multidimensional trait and used both biographical and behavioral measures of creativity [creative personality, creative achievements in multiple domains, creative ideation, problem solving, and divergent thinking] in large participant populations, including both student and non-student samples under different test conditions. This holistic approach is in line with recent studies advocating the use of a large, diverse group of measures to capture creativity (Eisenman, 1969; Cropley, 2000; Fields and Bisschoff, 2013). We propose that given the multidimensional nature of creativity, a holistic measurement will be more effective in capturing this construct.

In conjunction with the creativity measures, a gambling task called Roulette Betting Task (RBT) was employed to measure risk taking (Studer and Clark, 2011). This task has been shown to be a simple yet effective tool for measuring variables related to risk taking. However, while the gambling tasks provide an effective method of identifying risk taking in the financial domain, they do not guarantee that the resultant measures are applicable more generally. Indeed, to better capture the complex nature of risk taking, several researchers have argued for the need to measure risk taking in several domains. Slovic (1964), one of the early advocates of this idea, questioned the assumption that financial risk taking is a robust predictor of other types of risk taking. Following Slovic's idea, other researchers have developed measures intended to examine risk taking tendencies in more than one domain. Weber et al. (2002), identified five domains of risk taking and developed a questionnaire called *DOSPERT* (*Domain Specific Risk Taking Questionnaire*) based on their results (Blais and Weber, 2006). There is now sufficient evidence, from studies with diverse populations (Hanoch et al., 2006; Rolison et al., 2014), to support Slovic's argument, demonstrating the need to investigate risk taking across multiple domains.

Domain specificity is particularly relevant for our understanding of risk in relation to research in creativity because risk taking in some domains appears to be more pertinent to creativity than others. For example, it is possible that some domains of risk taking (such as social or recreational) are more closely associated with creativity than others (for instance, gambling). Sternberg (1997) provided support to this notion by referring to the importance of 'sensible' risk taking in creativity. He emphasized that the risk of being 'different' is more important in creativity than risks that endanger limbs or life. In line with these views, the current study aimed to systematically investigate the association between domain specific risk taking and a holistic measurement of creativity. We predicted that specific domains of risk taking such as social risk taking (i.e., the willingness to challenge norms) would show a positive association with creativity. We investigated these associations in a laboratory-based study which included behavioral and questionnaire based measures of creativity and risk taking. This was followed by an online study with a larger and more diverse group of individuals in order to explore the wider validity of the findings. To our knowledge, this is the first study to systematically investigate the relationship between domain specific risk taking and creativity.

STUDY 1

All the data for the first study were collected under laboratory based conditions from participants based in the UK.

Method

Participants

Sixty-four volunteers (34 female, $M_{age} = 23$ years, $SD = 4.36$), were recruited from a paid participant pool and via posters across the university. All participants were paid €8 for their participation. The study received ethical approval from the research ethics committee at the researchers' university.

Measures of Risk Taking

(i) Roulette Betting Task

The RBT was used as a behavioral measure of risk taking alongside the questionnaire based measure (DOSPERT). In this task, participants were presented with a wheel containing 10 segments or 'pockets' on a computer screen. Each pocket was either red or blue colored. Through verbal and written instructions, participants were informed that the blue pockets were associated with wins while red with losses. In each trial, they were presented with three boxes indicating the available bet options – low, medium, and high. Participants were instructed to select one bet, and upon selection, the wheel spun for a variable amount of time (3–3.5 s) before randomly stopping on one of the 10 pockets. Finally, a text feedback indicated whether they won or lost the money. The ratio of blue to red colored pockets determined the probability of winning. This probability was varied at three levels – small (40% chance of winning), medium (60%), and large (80%). The probabilities of rewards and magnitude of the bet options were randomized across all trials. In total, 100 trials were presented to each participant. Before the commencement of the task, they were informed that the highest score obtained by one of the participants on this task would be converted into a monetary donation to a local charity of their choice.

(ii) Domain Specific Risk Taking Scale (DOSPERT)

DOSPERT is a standardized questionnaire which contains 30 questions related to five different domains of risky behaviors (Ethical, Financial, Health/Safety, Recreational, and Social) (Blais and Weber, 2006). Each domain contains six questions and individuals rate the likelihood of engaging in risky activities on a seven point Likert scale. Higher values on the scale represent higher chances of engaging in risk taking. Sample items on the scale include "Disagreeing with an authority figure on a major issue" (social), "Passing off somebody else's work as your own" (ethical), "Driving a car without wearing a seat belt" (health/safety), "Bungee jumping off a tall bridge" (recreational), and "Betting a day's income at a high-stake poker game" (financial). The scale ranges from 'extremely likely' to 'not likely at all.'

DOSPERT also measures perception of risk (from 'extremely risky' to 'not at all') and expected benefits (from 'great benefits' to 'no benefits at all') on seven point scales. 'Risk perception' responses measures individuals' gut-level assessment of risk. On the other hand, 'expected benefits' responses evaluate the degree of benefit that an individual sees in each risky activity.

Measures of Creativity

(i) Divergent Thinking Task

The alternate uses task (AUT) measures divergent thinking in individuals (Guilford, 1967). This task contains the names of several common household items (such as eyeglasses or a shoe) and participants were presented with these, one at a time. They were instructed to generate as many unusual uses as possible for each item. There was no limit on the time individuals took to record their responses; however, they were instructed to spend at least 2 min on each object. This time limit was carefully monitored by the experimenter. We administered the test using a computerized version of the test items and hence instructed our participants to type in their responses.

(ii) Compound Remote Associates Task (c-RAT)

The compound remote associates task is based on the original task (Mednick, 1968) and provides a wide variety of remote associates problems (Bowden and Jung-Beeman, 2003). In each of these problems, participants are presented with three words which are associated with a target word. The task for participants is to find the target word. Every correct response increases the total score by one. We selected thirty items from a set of 144 items provided in c-RAT. All of the items were randomly selected from a uniform distribution across all the difficulty levels. The task was presented on a computer and participants had 15 s to type in their responses in each trial.

(iii) Creative Achievement Questionnaire (CAQ) and Runco's Ideational Behavioral Scale (RIBSs)

Creative Achievement Questionnaire assesses achievement across 10 different domains of creativity: music, visual arts, architecture, scientific discovery, culinary arts, dance, theater and films, inventions, writing and humor (Carson et al., 2005). It is a self-report measure in which participants are asked to report their achievements in these 10 domains.

Runco's Ideational Behavioral Scale is a self-report measure of creativity which measures creative ideation (Runco et al., 2001). Participants are asked to report how frequently they generate ideas on a five-point scale (from never to daily) in response to nineteen different questions relating to their day-to-day ideas and ideation ability.

(iv) Creative Personality Scale (CPS)

Developed by Gough (1979), the creative personality scale (CPS) presents participants with a set of thirty adjectives. Gough identified a list of adjectives which comprise a creative personality and contrasted them with adjectives which do not. Participants indicate the adjectives that apply to them via a checklist. These adjectives are then scored positively or negatively according to a standardized scoring key to calculate the composite creative personality score.

Self-Reports

In addition to the tasks and questionnaires, participants were asked to rate themselves on 'how creative they are' and 'how risk taking they are' on five-point Likert scales.

Procedure

All the tasks were presented using Psychopy2 (Peirce, 2007; Peirce, 2009). Questions and ratings for all the questionnaires were presented in an online survey web service with no restriction on time (SurveyMonkey Inc.)[1]. All the tasks and questionnaires were spread across two, 1-h sessions for each participant. Each session consisted of tasks followed by questionnaires and the order of tasks and questionnaires was randomized across participants.

Data Analysis

The RBT provided two measures of financial risk taking behavior. The average bet amount across all the decision trials provided a measure of financial-gambling related risk taking for each participant (average bet). The change in bet amounts as a function of the probability of winning (the slope of the best line of fit), provided a measure of adjustment to risk (gambling risk adjustment). For creative thinking tasks, standard measures of analysis were used. The divergent thinking task allowed a measurement of originality and fluency; originality was the average statistical infrequency of the ideas and fluency score was the total number of ideas generated by each participant. Scores on the compound remote associates task were obtained by a summation of all the correct responses.

All the questionnaire scores were calculated using standard scoring keys and scoring procedures provided with respective questionnaires. We followed the suggestions provided in Silvia et al. (2012) and calculated nominal scores for each domain in the CAQ in order to avoid conducting further statistical analysis on skewed raw scores. The threshold for calculating the nominal scores were 0 (=0), 1 to10 (=1), and more than 10 (=2). A total CAQ score across all the domains was used in subsequent analyses. CAQ provided a creative achievement score while RIBSs provided a score of ideation fluency. Finally, DOSPERT provided scores for risk taking in each of the five risk domains.

Performance on all the tasks and scores from questionnaires were entered in a multiple correlational analysis where each factor was pairwise correlated with all the other factors. We chose to perform Bayesian correlation analysis on our data since it allowed us to analyze the probability of both null (Bayes Factor BF_{01}) and alternate hypothesis (Bayes Factor BF_{10}) testing. We used a stringent threshold of Bayes factors higher than 30 for determining the *very strong evidence* in favor of the presence of correlations. In order to interpret our results, we followed Jeffreys' suggestions (Jeffreys, 1961; Jarosz and Wiley, 2014), which provide an easy to interpret table of Bayes factors. In short, Bayes factor (BF_{XY}) from 10 to 30 suggests a strong evidence for X; BF_{XY} from 30 to 100 suggests a very strong evidence for X and BF_{XY} greater than 100 is decisive for X. Moreover, a non-informative, uniform prior with a beta prior width of 1 was used throughout the analysis. An open source statistical analysis software called JASP (JASP Team, 2016) was used to conduct all the statistical analyses.

[1]www.surveymonkey.com

Results

Fluency and originality scores on the divergent thinking task did not yield strong evidence of correlation with either task based or DOSPERT based measures of risk taking ($BF_{10} < 3.5$ for average bets, adjustment of bets, social, ethical, financial, health-safety and recreational risk likelihood, perception and benefits). There were also no statistically supported correlations between scores of divergent thinking and other measures of creativity ($BF_{10} < 1.6$ for CPS, RIBS and CAQ). Similarly, c-RAT scores did not show any supported correlations with either measures of risk taking ($BF_{10} < 0.4$) or with other measures of creativity ($BF_{10} < 0.43$).

A paired samples *t*-test was conducted to compare the average bet placed in each probability condition. We found a significant linear increase in the average bet as the probability of winning increased ($p < 0.001$ for the within subject linear effect; non-significant for the within subject quadratic effect) (**Figure 1**). There was a significant difference in the average bets placed in 40% ($M_{bets} = 26.26$, $SD = 8.36$) and 60% ($M_{bets} = 45.17$, $SD = 12.60$) probability trials [$t(63) = -12.27$, $p < 0.001$] as well as between 60 and 80% ($M_{bets} = 70.21$, $SD = 11.94$) probability trials [$t(63) = -14.58$, $p < 0.001$].

Neither measure of financial risk taking behavior as measured by the gambling task showed strong evidence of correlations with any measure of creativity ($BF_{10} < 0.6$ for CPS, RIBS, CAQ, Fluency and Originality scores). Similarly, there was a lack of supported correlation between the likelihood of risk taking in the financial-gambling domain as measured by DOSPERT and the available measures of creativity ($BF_{10} < 2.6$). Following the same trend, we found that the likelihood of risk taking in recreational, financial-investment, health and safety and ethical domains also showed no supported correlations with measures of creativity ($BF_{10} < 2.1$). In contrast, scores on CPS (Pearson's $r = 0.42$, $BF_{10} = 49.4$), CAQ (Pearson's $r = 0.46$, $BF_{10} = 233.14$) and RIBS (Pearson's $r = 0.4$, $BF_{10} = 32.19$) demonstrated strong evidence

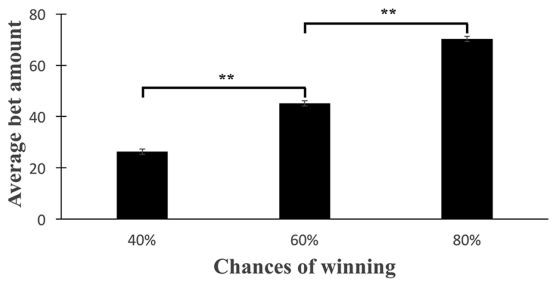

FIGURE 1 | Adjustment to risk. Average bets selected showed a linear increase as the probability of winning increased (**$p < 0.001$ in a pairwise *t*-test).

TABLE 1 | Domain specific risk taking and creativity: Study 1.

	Gambling		Likelihood of taking risks					
Creativity	**Average bets**	**Risk adjustment**	**Social**	**Recreational**	**Financial (Gambling)**	**Financial (Investment)**	**Health and Safety**	**Ethical**
CPS	***−0.01***	***−0.007***	***0.42****	***0.22***	***−0.04***	***0.03***	***0.18***	***0.18***
	0.16	0.16	49.4	0.675	0.163	0.16	0.422	0.403
CAQ	***−0.09***	***0.02***	***0.47****	***0.24***	***0.10***	***0.18***	***0.20***	***0.18***
	0.2	0.16	233.149	0.943	0.215	0.408	0.524	0.422
RIBS	***−0.20***	***−0.11***	***0.40****	***0.18***	***0.27***	***0.29***	***0.29***	***0.28***
	0.55	0.22	32.195	0.436	1.511	2.073	2.143	1.947

Correlation table with Pearson's correlation coefficients (in bold, italics) and their respective Bayes factors underneath them. Statistically supported correlations are marked (BF_{10} > 30, **BF_{10} > 100). CPS, Creative Personality Scale; CAQ, Creative Achievement Questionnaire; RIBS, Runco Ideational Behavioral Scale.*

of correlations with the likelihood of risk taking in the social domain (**Table 1**).

Perception of risks and expected benefits did not show supported correlations with CPS, CAQ, or RIBS in any domain of risk taking (BF_{10} < 1.7). Only exception to this trend was a correlation between CAQ scores and expected benefits in the social domain (Pearson's $r = 0.45$, $BF_{10} = 162.7$).

Discussion

The results from this study demonstrate a strong link between risk taking in the social domain and personality and biographical inventory based measures of creativity. Other domains of risk taking were not significantly associated with any measure of creativity. Social risk taking is particularly interesting to investigate in the context of creativity. Creative individuals often present their ideas and creative products to social groups, for evaluation, appreciation, or criticism. This activity involves a high level of social risk especially since it entails the possibility of the creative idea or product being rejected by some, or all the individuals forming the social group.

Most participants reported that cRAT was extremely difficult and that they could not solve most cRAT problems in the time limit of 15 s. This was reflected in their scores, the maximum number of problems solved was 15 (out of 30). Accordingly, cRAT scores were removed from the subsequent analysis. Surprisingly, despite the widespread use of divergent thinking tasks as a proxy measure of creativity, divergent thinking scores showed no supported correlation with measures of risk taking and they were also not correlated with other measures of creativity. These results add to a plethora of literature questioning the appropriateness of the established divergent thinking based measures of creativity.

STUDY 2

Given the relatively smaller sample size and homogeneous group of participants in Study 1, it is possible that participants' creative achievements, ideation and personality were restricted by their experiences. Consequently, we ran a second study on a large and more diverse group of participants living in the USA.

Method

Participants

Four hundred and seventeen participants (M_{age} = 36 years, SD = 12.26, 223 female) took part in this study for monetary compensation on a popular survey platform called Mechanical Turk (Buhrmester et al., 2011).

This study incorporated CAQ, RIBSs, CPS, DOSPERT, and self-reports (refer to Study 1 for details). It was self-paced and on average lasted for less than 30 min. In a manner similar to Study 1, we performed a multiple pairwise correlation analysis. Additionally, we were interested in investigating the degree to which risk taking in each of the five domains would predict measures of creativity. All scores from the questionnaires and self-reports were included in the correlation analysis which consequently informed the regression model. Finally, we performed additional analysis in order to find the effect of gender on creativity.

Results

There were no differences between male and female groups on any scale of creativity. A multiple pairwise Bayesian correlation analysis showed that self-reports of risk taking showed strong evidence of correlations with the likelihood of risk taking in all the domains (BF_{10} > 30 for all domains, Pearson's r for social = 0.22, recreational = 0.54, financial/gambling = 0.35, financial/investment = 0.41, health/safety = 0.42, ethical = 0.37). Additionally, self-reports of risk taking were correlated with self-reports of creativity (Pearson's r = 0.31, BF_{10} > 100), CPS (Pearson's $r = 0.29$, BF_{10} > 100) and RIBS (Pearson's $r = 0.31$, BF_{10} > 100) (**Table 2**).

Measures of creativity and that of risk taking showed satisfactory internal consistency (Cronbach's alpha for RIBS = 0.89, CPS = 0.77, CAQ = 0.62, social likelihood = 0.76, recreational likelihood = 0.84, financial/gambling likelihood = 0.91, financial/investment likelihood = 0.82, health/safety likelihood = 0.75 and ethical likelihood = 0.78). Pairwise correlations for a linear relationship of the likelihood of social risk taking with CPS and RIBS demonstrated strong statistical evidence (**Table 2**). The likelihood of taking recreational risks was found to be show supported correlations with all three measures of creativity while financial (investment)

TABLE 2 | Domain specific risk taking and creativity: Study 2.

Creativity	Risk	Likelihood of taking risks					
Measures	Self-reports	Social	Recreational	Financial (gambling)	Financial (Investment)	Health and Safety	Ethical
CPS	***0.29***	***0.33***	***0.26***	***0.03***	***0.24***	***0.13***	***−0.003***
	4.917e+6	1.500e+9	118945.7	0.074	13533.62	2.129	0.061
CAQ	***0.16***	***0.15***	***0.20***	***0.13***	***0.16***	***0.16***	***0.14***
	9.484	6.141	228.7	2.095	15.35	14.95	3.385
RIBS	***0.31***	***0.29***	***0.26***	***0.22***	***0.25***	***0.21***	***0.14***
	6.857e+7	6.972e+6	88645.4	1753.16	55209.14	677.956	2.922

*Correlation matrix with Pearson's correlation coefficients (in bold, italics) and their respective Bayes factors underneath them. Statistically supported correlations are marked (**BF_{10} > 100). CPS, Creative Personality Scale; CAQ, Creative Achievement Questionnaire; RIBS, Runco Ideational Behavioral Scale.*

related risk was correlated with CPS and RIBS. None of the measures of creativity showed a supported correlation with risk perception in any domain (BF_{10} < 4.2). Similarly, CPS did not show any supported correlation with expected benefits in any domain (BF_{10} < 0.6). Finally, RIBS showed supported correlations with expected benefits only in the social (Pearson's r = 0.26, BF_{10} > 100) and recreational domain (Pearson's r = 0.25, BF_{10} > 100).

We ran three linear regression models each predicting creative personality (CPS), ideation (RIBS), and achievements (CAQ) using the likelihood of risk taking in each of the domains as predictors. The method used to build these models involved entering all the domains of risk at the same time. Additional stepwise methods of entering the domains of risk yielded the same result. Only the likelihood of risk taking in the social domain significantly predicted both creative personality and ideational ability [CPS: $F(6,410) = 12.83$, $p < 0.001$, $R^2 = 0.16$, standardized coefficient for social risk taking = 0.237, $p < 0.001$; RIBS: $F(6,410) = 12.05$, $p < 0.001$, $R^2 = 0.15$, standardized coefficient for social risk taking = 0.243, $p < 0.001$]. None of the other domains of risk taking were significant predictors of these creativity measures. None of the domains of risk taking predicted CAQ scores significantly [$F(6,410) = 4.04$, $p < 0.001$, $R^2 = 0.06$, social $p = 0.076$, recreational $p = 0.12$, financial 0.39, health-safety $p = 0.97$ and ethical $p = 0.56$].

Discussion

Results from this study corroborated the results from Study 1, thus confirming a clear association between social risk taking and personality and biographical inventory based measures of creativity. Interestingly, additional correlations were observed with other domains of risk taking in this study such as recreational, financial, and health-safety. Notably, the coefficient values for correlations between social risk taking and CPS as well as with RIBS decreased and stabilized in this study due to an increase in the sample size. This effect has been investigated in greater detail in previous studies. For instance, Schönbrodt and Perugini (2013) showed that for smaller sample sizes (such as in Study 1), Pearson's coefficients fluctuate considerably and sometimes even change signs. However, with increasing sample size, the correlation coefficients decrease until they finally stabilize at a sample size of 200–250. Therefore, the larger sample size in Study 2 provided confidence required for the statistically supported results. Moreover, a multiple linear regression analysis showed that only social risk taking is a significant predictor of the ideation and personality based measures of creativity. Other domains of risk taking did not predict any measure of creativity in this study.

GENERAL DISCUSSION

"I am always doing that which I cannot do, in order that I may learn how to do it." This quote by the creative polymath Pablo Picasso is one of the many, that identify the importance of taking risks in creativity. Previous scientific literature investigating the association between creativity and risk taking has reported mixed findings, mainly due to the differences in the size and type of participant sample and the specific instruments employed to measure risk taking and creativity (Strum, 1971). Most of these studies have reported measuring related but indirect variables; for instance, adventurousness for risk taking and divergent thinking for creativity. Previous reports have also been limited by their differentially motivated approaches; many sought out to investigate factors such as personality traits (Ivcevic and Mayer, 2006), promotion and prevention cues (Friedman and Förster, 2001), academic risk taking (Strum, 1971) or mathematical creativity (Erbas and Bas, 2015). In contrast, the current investigation was aimed at investigating the relationship between risk taking and creativity using a variety of behavioral, biographical, and personality based measures. The motivation for the current study specifically led us to ask the following question – Is risk taking generally associated with creativity or is this association domain specific?

The results from the first study indicated that among the six domains of risk taking, only social risk taking shows strong evidence for correlations with CPS, ideation, and creative achievements. None of the other domains of risk taking, as measured by the gambling task and risk taking questionnaire showed a statistically supported correlation with any of the measures of creativity. These results corroborate Sternberg's idea of 'sensible' risk taking in creativity. He proposed that

some domains of risk taking are more pertinent to creativity (for instance, the idea of being socially 'different') than others such as health and safety (risk of losing limbs or life) (Sternberg, 1997). Presenting a radical idea to a social group, unveiling a new artwork at an exhibition, publishing a collection of stories or poems and many other forms of social interactions involve a high degree of risk. All of the aforementioned acts are risky since there is always some uncertainty associated with the social evaluations. These creative acts thus require individuals who are willing to take risks in the social domain.

The second study was based on a much larger sample size and a diverse group of participants. The larger sample size also provided the statistical confidence required for the regression models. The results from this study demonstrated that social risk taking was the only statistically significant predictor of the measures of creativity. This provided support for our initial findings that creative individuals are more likely to take risks exclusively in the social domain.

The lack of correlation between financial risk taking in the gambling domain and measures of creativity is particularly important to discuss, since in most studies of risk taking, performance on gambling tasks is often equated to a general tendency toward risk taking. Our results from both the performance on the gambling task and scores from the questionnaires point toward the same direction; risk taking in the financial-gambling domain is not related to creativity. These results provide further evidence for the argument that the association between risk taking and creativity is domain specific.

Relationships between risk taking in the other domains (such as ethical) and creativity have been studied in specific scenarios such as deception (Gino and Ariely, 2012; Mai et al., 2015). For instance, Gino and Ariely (2012) reported that individuals with creative personalities cheated more than others in a deception task. Additionally, priming individuals to think creatively led them to be more likely to exhibit unethical behavior. We did not find support for these findings in our study. Both studies in the current research indicated that the likelihood of taking ethical risks is not related to measures of creativity. Niepel et al. (2015) recently criticized the study by Gino and Ariely, suggesting that due to the artificial nature of the deception tasks, participants were not only presented with the opportunity to behave dishonestly but they were also tempted to do so. They reported that self and teachers' reports of creativity in a sample of students are positively linked to ethical decision making (as opposed to the negative associations found previously). Additionally, they reported that in the long term, creativity was not a general predictor of ethical decision making. Given the current scientific evidence, it is difficult to draw a strong conclusion based on these mixed findings and the question of the relationship between ethical risk taking and creativity remains unanswered.

We found mixed results with creative achievement scores in our study. While CAQ scores were significantly correlated with social risk taking in Study 1, we did not find this in our larger, diverse group of participants in Study 2. Additionally, none of the domains of risk taking were significant predictors of CAQ scores in the regression model. Inconsistency in the results may arise from the scoring structure of CAQ. Scores from this questionnaire are known to be highly skewed and several researchers have suggested using a nominal scoring procedure to avoid using raw scores (Silvia et al., 2012). Although, we have adopted this approach in our data analyses to limit the skewness in the scores, there are limitations to these correctional procedures and these are amplified as the datasets get larger. Consequently, it might have resulted in the differences in the two datasets. Future research could shed light on this association by using different measures of creative achievements (e.g., An and Runco, 2016; Paek et al., 2016).

Interestingly, unlike the questionnaire-based measures, the task-based measures of creativity did not correlate with risk taking (nor did they correlate with other measures of creativity). The tasks of creativity, such as the AUT measure divergent thinking, a component of creativity. Divergent thinking has been theorized as an important dimension of creativity, however, it doesn't comprise all of it (Baer, 2011). Moreover, divergent thinking tasks aim to measure creativity in a very short time period. From our results, it seems likely that attitudes of risk taking in the social domain are related to biographical and personality based measures of creativity (creative personality, ideation, or achievements) as opposed to the task based measures.

Limitations and Future Directions

Although the present research has shown that there is a significant association between creative personality and social risk taking, this study did not aim to explore the causal link between them. Previously, Dellas and Gaier (1970) have suggested that it is the personality traits which affect creative behavior, rather than the reverse. Future studies could explore the possibility of manipulation of social risk taking and investigating its effects on creativity. Additionally, external factors such as societal norms affect how individuals react to their own and others actions involving risk and uncertainty. This could be an important factor manipulating creative output. For instance, in some cultures, questioning authority is often suppressed and all forms of risk taking (calculated or otherwise) are discouraged when compared to the others. Future studies could investigate the extent to which cultural differences affect both risk taking and creativity.

CONCLUSION

Our study demonstrates that individuals who possess a creative personality and mind-set are more likely to take risks exclusively in the social domain. These results thus highlight the importance of the role social risk taking attitudes play in creativity. The current research also emphasizes the need to investigate risk taking in a domain specific context. In our understanding, this

is the first study to show that not only is creativity linked to risk taking, but also that this relationship is highly domain specific.

AUTHORS CONTRIBUTIONS

All authors contributed to the design of the study, analysis or interpretation of the data. VT wrote the manuscript, YH, SH, MR, and SD provided critical inputs. All authors gave the final approval to the current version of the manuscript.

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